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Differential effects of unconventional monetary policy on syndicated loan contracts *

Sumiko Takaoka† and Koji Takahashi‡

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Abstract

We investigate the effects of monetary policy on the financing policies of firms through the expected market interest rate channel at the firm level with Japanese syndicated loan contracts from 2000 to 2016, when monetary policy in Japan was almost stuck at the zero bound and the Bank of Japan introduced various unconventional monetary policy measures. To identify the interest rate channels of this monetary policy, we control for both observed and unobserved firm heterogeneity and unobserved time-varying bank heterogeneity in loan contracts. The evidence presented here demonstrates that both pricing (loan spread) and non-pricing (loan maturity) terms of loan contracts are affected by monetary policy shocks. In particular, monetary policy shocks have heterogeneous effects on loan maturity. The response to a monetary policy shock associated with a decrease in long-term interest rates is significant only for the borrower group with access to bonds, that is, less financially constrained firms.

JEL classification: E43, E52, G21

Keywords: Syndicated loans, Monetary policy, Loan maturity, Loan spread

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1 Introduction

The credit supply conditions for Japanese firms have changed drastically since 2000 when the Bank of Japan (BOJ) made changes in its operating procedures and communications strategies. Japanese firms experienced a lifting of the zero interest rate policy in 2000, the introduction of a quantitative easing policy in 2001, the turmoil of the global financial crisis, and loose monetary conditions under low interest rates. Although the BOJ introduced various unconventional monetary policy measures, including forward rate guidance and asset purchasing programs, on the borrower's side, many firms still accumulated cash after the global financial crisis. Against this background, the effects of monetary policy on firms' demand for credit became blurred. Key questions include whether and how interest rates at historically low levels under the unconventional monetary policy affected the financing policies of firms. That is, is an interest rate channel operational at the firm level?

The effects of monetary policy on the lending behavior of banks have been extensively studied using macro-level data such as Bernanke & Blinder (1992), bank-level data such as Kashyap & Stein (2000), and loan level data such as Khwaja & Mian (2008), among others. In order to disentangle the supply from the demand for loans, Jiménez et al. (2012) and Jiménez et al. (2014) analyzed the effects of monetary policy on credit supply by controlling time-varying observed and unobserved firm and bank heterogeneity with loan application records. In particular, Jiménez et al. (2014) demonstrated that a lower overnight interest rate induces banks to engage in higher risk-taking in their lending through loan applications and contracts. While these earlier papers provide decisive approaches and evidence for the effects of monetary policy on the supply of credit, this paper is the first to empirically identify the impacts of monetary policy on the financing policies of firms through the expected market interest rate channel.

Using tranche-level domestic syndicated loan contracts from 2000 to 2016, we identified the financing policies of firms and broke down the loan contracts into pricing (loan spread) and non-pricing (loan maturity) terms. The demand for syndicated loans is rooted in corporate activity, which enables us to isolate the firm's demand for loans. However, the identification challenges for testing the expected market interest rate channel remain. As a loan contract is a mutual agreement between a borrower and a lender, the terms of the contract reflect both demand-side and supply-side factors. To test the expected market interest rate channel, we controlled the firm's unobserved

heterogeneity with the borrower fixed effects, which could have stemmed from the firm balance-sheet channel of monetary policy at the firm level. In addition, industry-by-year fixed effects are included to control the relevant business cycle variation. More importantly, for arranger banks, which will be referred to simply as banks in this paper, unobserved and time-varying heterogeneity is controlled through bank-by-year fixed effects, which could have stemmed from the bank balance-sheet channel of the monetary policy.

Our estimation strategy begins with baseline models to explain loan spread and loan maturity of the loan contracts. As both terms (loan spread and maturity) are important for exerting practical influence on firms' decisions on investment and investment activities, a large body of the literature explores the factors influencing them and explains the borrower's choice by focusing on, for example, agency costs (in Myers (1977) and Barnea et al. (1980)), asymmetric information (in Flannery (1986), Diamond (1991), and Guedes & Opler (1996)), the cyclical nature of debt and debt maturity (in Emery (2001) and Becker & Ivashina (2014)), supply-side factors (in Custódio et al. (2013)), taxes (in Brick & Ravid (1985) and Fan et al. (2012)), and other market friction. From these findings from the literature, we explored the determinants of loan spread and maturity from our baseline results. Furthermore, we controlled the observed and unobserved characteristics of the borrower and its relevant business cycle variation with borrower fixed effects and industry-by-year fixed effects stemming from the borrower (firm) balance-sheet channel of monetary policy for the following tests. Then, we added variables relating to macroeconomic and credit supply conditions with bank-by-year fixed effects to fulfill the specifications, which controlled for the bank's unobserved and time-varying heterogeneity stemming from the bank balance-sheet channel of monetary policy.

Another identification challenge in this study is how to measure the monetary policy stance in Japan during our sample period. Since the 1990s, the Japanese short-term interest rates have remained very low, or even zero, and the BOJ introduced various unprecedented monetary policies such as zero interest rates, forward guidance, quantitative easing (QE), quantitative and qualitative monetary easing (QQE), and negative interest rates. In an extremely low interest rate environment, the short-term policy rate is not an appropriate measure for the monetary policy stance. This difficulty is well recognized among researchers, and a growing body of the literature has proposed a method to identify monetary policy shocks and to measure the effects of monetary policy shocks; for example, measuring monetary policy surprises through movements in asset prices in Gürkaynak

et al. (2005b) and Gertler & Karadi (2015), and applying a method of principal components to data on assets prices in Gürkaynak et al. (2005a), Wright (2012), and Rogers et al. (2014). We applied this standard method of principal components to identify monetary policy shocks and the responses of asset prices to monetary policy announcements, and then examined their effects on loan contracts. Despite these difficulties, with strong bank-firm relationships, a long period of very low interest rates, and the BOJ's various unconventional monetary policy measures, Japan provides a unique and useful setting for testing the effect of monetary policy shocks on the financing policies of firms.

We observed that monetary policy shocks associated with increases in short-horizon swap rates and risky asset prices induce higher loan spreads. We refer to this policy shock as the *expansionary twist shock*. This monetary policy shock leads to a higher loan spread through the expected market interest rate channel, which is due mainly to the reaction of short-horizon rates. The *expansionary twist shock* also exerts influence on the maturity of loan contracts as it induces the borrower to shorten the maturity in loan contracts when it is associated with a decrease in long-term interest rates. Our estimation results confirmed the survey results in Graham & Harvey (2001), that is, corporate executives attempt to time their interest rates and borrow short-term credit when they expect the long-term rates to decline.

Given the fact that borrowers face different financial constraints, we examined whether the borrowers' responses to monetary policy shocks are uniform by dividing our sample into borrowers with access and borrowers without access to the public corporate bond market. While estimation results provide weak evidence in the loan spread models, the *expansionary twist shock* has significant and negative effects only on firms with access to bonds in loan maturity models. Thus, borrowers with access to bonds are more likely to time the market by borrowing short-term credit when they expect the long-term rates to decline. As borrowers with access and without access to bonds face different financial constraints, the estimation results suggest differential effects of monetary policy shocks across borrowers with different credit quality through the expected market interest rate channel. The estimates demonstrate that our major contribution to the literature is the identification of the expected market interest rate channel in the financing policies of firms, under the unconventional monetary policy regime, and this effect depends on the borrowers' financial constraints.

The remainder of this paper is organized as follows. Section 2 provides the institutional back-

ground and discusses the trends in Japanese syndicated loans. Section 3 describes our data and estimation strategy. Section 4 provides our baseline results. We identify the unconventional monetary policy shocks and the results of the monetary policy shock effects in Section 5, while the final section offers some concluding remarks.

2 Institutional Background and Trends

The Japanese economy is characterized by a corporate loan market based on tight banking relationships. Bank loans have been the main source of funds for Japanese firms, especially until the 1980s. In the 1990s, some listed firms obtained better access to other credit markets such as the bond market, but bank loans continued to be the main funding source for small- and medium-sized firms. Moreover, the close relationship between borrowing firms and lending banks —the so-called main bank system—has played an important role in the performance of firms. This structure can typically be compared to the market-centered credit market system in the United States (for example, see Peek & Rosengren (2005) and Hoshi & Kashyap (2001)). In this tight relationship, Japanese firms raise funds mostly through bank loans from individual lenders with whom they once transacted. In particular, the Japanese main bank system of long-term relationships between banks and firms (lenders and borrowers) is considered to have fostered Japanese post-war (WWII) economic development from the 1950s to the mid-1970s, when firms needed external finance (Aoki et al. (1994)). The key economic role of the main bank system in Japan has been broadly discussed in the literature by (Aoki et al., 1994; Weinstein & Yafeh, 1998; Hoshi & Kashyap, 2001; Shin & Kolari, 2004), among others.

Although banking relationships have helped in the rapid growth of the post-war Japanese economy, focusing on the nexus between problems in the banking sector and low productivity growth demonstrates that this was one of the reasons for the prolonged low economic growth periods of the 1990s after the collapse of the bubble economy.[1] The deterioration in the financial conditions of Japanese banks led to the syndicated loan market becoming another source of funds for firms that wanted to shift their funding sources from bilateral lending, which excessively relied on the main bank system. Furthermore, the banks that were under pressure to shrink their risk assets, especially

[1] See Hoshi & Kashyap (2004) for a discussion about economic stagnation and Japan's financial crisis. Peek & Rosengren (2005) also demonstrate the misallocation of credit by troubled Japanese banks, who had an incentive to allocate more credit to severely impaired borrowers to avoid the realization of losses on their own balance sheets.

after the 1997-1998 Japanese financial crisis, wanted to spread their risk exposure between groups of lenders. In this financial crisis period, some smaller regional financial institutions found it difficult to manage their funds. Against this backdrop, the syndicated loan market captured firms' demand for loans, as it allowed them to draw funds when needed. For banks, the syndicated loan system appeared to be an attractive profit source, because it provided the lenders with additional returns such as arranger, agent, commitment, and facility fees. One reason why the syndicated loan market could not develop in Japan until then, was the legal concern that the commitment and facility fees could be considered deemed interest under the Rate Restriction Act (Act No. 100 of 1954) and the Act Regulating the Receipt of Contributions, the Receipt of Deposits, and Interest Rates (Act No. 195 of 1954). That is, when the actual lending amount is small, the amounts paid to the lender can exceed the legal interest ceiling as specified in the above Acts even if the amounts consisted of only a facility fee. However, the Act on Specified Commitment Line Contract (Act No. 4 of 1999) was enacted in 1999, establishing the legal foundation for the commitment line (revolving facility)-type syndicated loan contracts. Commitment fees and facility fees are not regarded as deemed interest to the extent prescribed by this Act; see Hirano (2007) and Sugahara et al. (2007) for the details.

Figure 1 illustrates the trends of syndicated loans, the total new loan volumes, and the number of syndicated loan deals issued each year in Japan from 2000 to 2016. While the borrowing data from the BOJ, the Total/New Loans for Fixed Investment, do not indicate notable growth in total new loan volume since 2000, the syndicated loan market has grown significantly.[2]

[Figure 1 around here]

An interesting feature is observed in the syndicated loan market trends during the 2007-2008 global financial crisis period (the subprime mortgage crisis and the Lehman Brothers bankruptcy). Other major markets around the world contracted during this period. For example, compared to the previous year, in 2008, syndicated lending declined by 50.2% in America, by 48.5% in EMEA (Europe, the Middle East, and Africa), and by 9.5% in Asia, excluding Japan and Australia, according to Thomson Reuters. On the other hand, the Japanese syndicated loan market grew by 35.8% in 2008 over the previous year, and this was the only major market that grew in 2008. One reason for this

[2]Although the coverage of the lender to which the Act on Specified Commitment Line Contract (Act No. 4 of 1999) is applicable does not exactly match the coverage in the statistics of the Total/New Loans for Fixed Investment from the BOJ website, this is the only available data on the yearly total new loan volume in Japan.

growth is that the impact of the global financial crisis on Japanese financial institutions was not as severe as that on U.S. and European financial institutions. Another is that Japanese firms refinanced their borrowing in anticipation of worsening market conditions in the near future. Moreover, they used the syndicated loan system as an alternative to corporate bonds during the crisis. This implies that syndicated lending not only allows a borrowing firm to avail a loan that could be too large for a single bank, but also serves as an important source of external finance amid the turmoil of the corporate bond market.

As for the composition of investors in the syndicated loan market, the Japanese syndicated market is almost dominated by banks, whereas in the United States, various types of institutional investors, such as commercial and investment banks, hedge funds, and private equity funds, play a major role. In addition, the wave of mergers of large banks in the early 2000s dramatically reduced the number of large banks in Japan. Since the 1980s, twenty large Japanese banks have merged to form three "megabank" groups (Mitsubishi UFJ, Mizuho, and Sumitomo Mitsui). In order to grasp the concentration of lead arrangers in the Japanese syndicated loan market, we calculate the Herfindahl-Hirschman Index (HHI) of lead arrangers for Japanese syndicated loans using the syndicated loan data from the Thomson One database.[3] Figure 2 illustrates the market concentration measures (CR4 and HHI) for Japanese lead arrangers from 2000 to 2016.

[Figure 2 around here]

One reason why the market concentration measures for lead arrangers in Japan have not declined over the past decade appears to be the wave of mergers.[4] From CR4 in Figure 2, the mergers and acquisitions (M&A) of megabanks have kept the shares high since the latter half of the 2000s.

[3]The HHI for syndicated loan lead arrangers is calculated as $HHI_t = \sum_{i=1}^{N} \left(\frac{100 s_{i,t}}{S_t}\right)^2$, where $s_{i,t}$ is the sum of deal proceeds—here, financial institution i is the lead arranger in year t—$S_t (= \sum_{i=1}^{N} s_{i,t})$ is the industry total (total amount of syndicated loans) in year t, and N is the number of lead arrangers who had at least one deal in year t. Due to the many mergers of financial institutions, we recode the proceeds by each lead arranger when the financial institutions merge to form a new financial institution in mid-year. In order to avoid double counting of the number of lead arrangers in year t, we aggregate the proceeds by each merged financial institution to the newly formed financial institution at the end of year t. If arrangers 1 and 2 merge to form arranger 3 in year t, we recode the proceeds arranged by arrangers 1 and 2 as proceeds arranged by arranger 3 in year t.

[4]Mizuho Holdings, Inc, one of the current three megabank groups, was established by the merger of Dai-Ichi Kangyo Bank (DKB), Fuji Bank (Fuji), and the Industrial Bank of Japan (IBJ) in September 2000, when all shares of the DKB, Fuji, and IBJ were acquired by the newly formed Mizuho Holdings. After this, a series of mergers in the early 2000s led to the formation of Mitsubishi UFJ Financial Group in October 2005. The other megabank, Sumitomo Mitsui Banking Corporation, was formed by the merger of the Sumitomo Bank and Sakura Bank in April 2001.

Another probable reason is that the leveraged loan market size in Japan shrank during the global financial crisis period and the recovery that followed was not sufficient to attract various institutional investors, because they continued to face many obstacles such as insufficient information revelation and secondary market problems.[5] The reasons for this high concentration also include the fact that many foreign financial institutions such as Citi, Credit Agricole CIB, BNP Paribas SA, Deutsche Bank, and JP Morgan decreased their arranged loan proceeds as Japanese banks increased their proceeds.[6] The market share of foreign lead arrangers was higher in the early 2000s, but it declined in the late 2000s, partly due to the global financial crisis. Some borrowers are believed to have switched their lead arrangers back to their main banks after the global financial crisis. However, the reason for the decline in the foreign bank market share is not straightforward because the large Japanese banks were experienced enough to facilitate and lead a group of financial institutions at that time.

The three megabank groups maintain a high market share in the lead arranger market. However, this does not necessarily mean that the environment surrounding the syndicated loan market is favorable for megabanks. Since the BOJ announced an asset-purchasing program in October 2010, the long-term interest rate has been trending downward. In addition, the BOJ initiated a QQE policy in April 2013, and then finally introduced a negative interest rate policy. The unprecedented monetary easing operation continues for an extended period, thus making it difficult for financial institutions to generate high returns.

These stylized facts about the patterns and trends of Japanese syndicated loans suggest that the design of the syndicated loan contract, including the pricing and non-pricing terms, might be influenced by the borrower's financial conditions, and by supply-side factors. In addition, the impacts of unconventional monetary policies on financial institutions and borrowing firms should be considered. We will carefully investigate these relationships in the following sections.

[5] In the United States, non-bank institutional investors are active players in the leveraged loan market. See Lim et al. (2014) for the loan market segment and non-bank institutional investors' participation.

[6] Citi is said to have launched the first commitment line type loan in March 1998 by claiming outright that commitment fees are not deemed interest even before the enactment of the Act on Specified Commitment Line Contract in 1999. See Sugahara et al. (2007).

3 The Data and the Estimation Strategy

We used a panel dataset to investigate the syndicated loan contracts and responses to monetary policy shocks empirically. For this analysis, we combined several different data sources. The data on tranche-level syndicated loan contracts were retrieved from the Thomson Reuter LPC DealScan. We retrieved the tranche-level loan data from January 1, 2000, to December 31, 2016, and the borrower country was Japan, and the tranche currency was JPY. We retrieved details on all completed deals, excluding bilateral deals. DealScan data are extensively used, in particular, for research in the United States and Europe. Previous papers on syndicated loans already provide details of DealScan data (for e.g., see Ivashina (2009) and Lim et al. (2014)). While the data on loan contracts such as borrower name, maturity, arranger and lender information, syndication information, tranche amount, tranche type, seniority type, and spread are taken from DealScan, the borrower firm's name is listed in English without providing the Securities Identification Code in Japanese. In order to identify the borrowers with their Japanese corporate names and to supplement the missing data, we utilized the loan deal data taken from the Thomson Reuters' Thomson One database, which provided information in Japanese.

The data on borrower's credit ratings and seven financial indicators—volatility (daily volatility over the last 30 days based on closing stock prices), ROE, long-term debt to equity, total debt to EBITDA, sales growth (YoY), EBITDA growth (YoY), and total assets—in the accounting year (for stock prices, trading day) immediately prior to each loan origination were drawn from the Thomson Reuters Eikon. We took the credit rating information, when available, from the DealScan database, and otherwise used the rating information from the Thomson Reuters Eikon. Credit rating information was derived from R&I, JCR, S&P, and Moody's. In order to maximize the sample size, we used the lowest available ratings provided by these four rating institutions. We combined the detailed data on individual syndicated loan contracts with the borrower's financial indicators and credit rating information.

For the pricing term of the syndicated loan contract, our base model for the loan spread on individual loan tranches takes the following form:

$$Spread_{i,j,l,t} = \alpha_j + \alpha_{l,t} + \beta_1 \mathbf{Controls}_{i,j,l,t} + u_{i,j,l,t} \tag{1}$$

The dependent variable, $Spread_{i,j,l,t}$, is the all-in-drawn spread, that is, the spread of the loan tranche i over the Tokyo Interbank Offered Rate (TIBOR) at time t in basis points, plus any annual

fees that the borrower j in industry l must pay the lender. We used the all-in-drawn spread because of data availability and following previous studies such as Lim et al. (2014). Borrower fixed effects, represented by α_j, absorb the unobserved borrower heterogeneity, which could have stemmed from the firm balance-sheet channel of monetary policy at the firm level. Two-digit NAICS industry-by-year fixed effects, represented by $\alpha_{l,t}$, are included to control the relevant business cycle variation.

The vector of variables, **Controls**, contains the following sets of variables: (i) the borrower's credit rating variables; (ii) the borrower's financial indicators; and (iii) the tranche characteristics. (i) The borrower's credit rating variables are 0-1 dummy variables. For example, *AA rating* takes the value of unity if the borrower's rating is AA+, AA, or AA- and zero otherwise, when the base rating is below a BB rating. Credit rating is the observable indicator of the firm's credit risk, and firms with higher credit rating have lower probabilities of defaulting on debts. Compared with a base rating, an AA rating (A, BBB, and BB ratings) indicates an improvement in the firm's financial conditions and is expected to lead to a decrease in loan spread.

For (ii) the borrower's financial indicators, a vector of variables capturing the firm's financial characteristics is included.[7] Firms with the same rating may have different risks and probabilities of default. Seven variables are included in this vector: *Volatility*, *ROE*, *Long-term debt to equity*, *Total debt to EBITDA*, *Sales growth*, *EBITDA growth*, and *ln(Total assets)*. *Volatility*, measured as the daily volatility over the last 30 days using the daily closing stock prices, is included to gauge the degree of uncertainty perceived by market participants in the firm's business. An increase in *Volatility* is expected to lead to an increase in spread. *ROE* is defined as the net income returned as a percentage of shareholder equity and indicates the borrower's profitability. Higher profitability is expected to decrease the loan spread. Two of the variables included in this vector, *Long-term debt to equity* and *Total debt to EBITDA*, are measures of debt ratio to gauge financial flexibility. As these ratios increase, the risks that the firm could face associated with financial hardships grow. We also include in this vector two measures of firm growth: *Sales growth*, used as a proxy for business expansion, and *EBITDA growth*, used as a metric of change in profitability. The total amount of assets is used to measure firm size as the logarithm of the firm's total real assets *ln(Total assets)*.

For (iii) tranche characteristics, a vector of variables related to the individual loan tranche characteristics reflects the different risks that creditors bear. *Tenor* measured in years refers to the

[7] A correlation matrix for a set of financial indicators was computed to determine whether there is a multicollinearity problem when they are put into the regression model together. As no highly correlated variables can be found among the financial indicators, we used all the variables in the regression model at the same time.

amount of time left for the repayment of a loan. The risk associated with a given loan contract is higher for a long tenor, holding other factors constant, and we expect a higher spread to compensate for this greater risk in the form of a premium. *Secured* takes the value of unity when the loan facility is secured, and it is expected to capture the effect of protecting the lender in case of a borrower's default. *Tranche type* is a set of 0-1 dummy variables for various types of tranche such as bridge loans, term loans, revolver lines, 364-day facility, and so on. A set of *Lender country* dummy variables controls the lender operating country. A variable *No. of Lenders* controls for the syndication size.

For the non-pricing term of a syndicated loan contract, the base model for maturity on the individual loan tranche $Maturity_{i,j,l,t}$, which refers to the length of time left to the maturity date (in months), is formed as follows:

$$Maturity_{i,j,l,t} = \alpha_j + \alpha_{l,t} + \beta_2 \mathbf{Controls}_{i,j,l,t} + \upsilon_{i,j,l,t} \tag{2}$$

where borrower fixed effects, represented by α_j, and two-digit NAICS industry-by-year fixed effects, represented by $\alpha_{l,t}$ are contained to absorb the unobserved borrower heterogeneity, which could have stemmed from the firm balance-sheet channel of monetary policy at the firm level, and to control the relevant business cycle variation, respectively. A set of explanatory variables is almost the same as the loan spread model, although a dummy variable *Subordinated* is included in **Controls** instead of a dummy variable *Secured* due to the collinearity when using a sample for the maturity model. *Subordinated* is a 0-1 dummy variable taking the value of unity when the seniority type is subordinated.

Table 1 provides the descriptive statistics for the variables used in the estimation and indicates a gap in the number of observations between the loan spreads and maturity. One main reason for this gap is that, in Japan, the disclosure of spread and fees is on a voluntary basis, and hence the available observations for loan maturity are much larger. Another reason is that different benchmark interest rates are used and reported to calculate the spreads such as LIBOR, TIBOR, Yen LIBOR, and prime rate. From the reported loan spread benchmarks, we use TIBOR as the benchmark interest rate to cover the largest number of observations in the loan spread model. The distribution of credit rating dummy variables and the *Tenor* (in years) variable is presented in Table 1 to assuage concerns that the properties of the samples in the analysis might differ between the loan spread and loan maturity models. The ratio of borrowers with an A rating is slightly higher in the loan

spread model, but no large gap is observed. In addition, as *Tenor* (in years), which corresponds to *Maturity* (in months) in the loan maturity model, has the same quantiles and mean value, no major difference between the samples was detected.

[Table 1 around here]

The **Controls** vector includes credit rating dummy variables for the AAA, AA, A, BBB, and BB rating groups. Previous studies have demonstrated that low-risk firms could prefer short-term borrowing to lower their borrowing costs because they are more likely to report good quarterly earnings in the near future than higher-risk firms. On the other hand, lenders are not willing to provide long-term credit to firms with very high risk.

Regarding the borrower's financial indicators, the expected coefficients on profitability measures *ROE* and *EBITDA growth* are negative. As these firms are expected to illustrate hopeful prospects when their sales figures are announced in the near future, they prefer to borrow short-term debt to lower their borrowing costs. Borrowers with higher *Long-term debt to equity* and *Total debt to EBITDA* ratios are expected to choose long-term borrowing to avoid liquidity risks by locking in long-term debt because borrowers with less financial flexibility can incur a liquidity risk if they refinance inopportunely. Previous studies have demonstrated that liquidity risk plays an important role in a firm's decisions, particularly with regard to debt maturity, because even low-risk borrowers can temporarily experience a loss in profits and refinance their debt inopportunely during economic downturns. Subsequently, firms attempt to avoid higher interest costs in bad times, or in a worse scenario, they are forced to shrink or forgo their business investments. Another theoretical implication provided by Fukuda et al. (1998) is the preference for long-term debt, even by low-risk borrowers, when faced with a liquidity risk; they tested this empirically using Japanese data from 1970 to 1996. Their results for the sample after 1980 strongly support their theoretical implication. We also expect positive coefficients on these variables. Variables associated with business size, *Sales growth*, and *ln(Total assets)* are expected to indicate the possible need for long-term debt to avoid the liquidation risk of losing their business.

As a tranche characteristic, we expect a positive coefficient on the variable *Subordinated* because a long-term subordinated loan is likely to be recognized as equity credit attributes by rating agencies. Some borrowers procure funds through subordinated syndicated loans that have equity credit attributes so that they can improve their financial ratios by capital reinforcement without diluting their shares.

4 Baseline Results

In this section, we begin with the baseline results for the pricing term, which indicates the loan spread, and the non-pricing term, which indicates the maturity, in loan contracts. We then saturate our baseline specifications with bank-by-year fixed effects to control time-varying and unobserved bank heterogeneity, which could have stemmed from the bank balance-sheet channel of monetary policy, and variables relating to macroeconomic and credit supply conditions to absorb the cyclical properties of loan contracts.

4.1 Spreads

Table 2 illustrates the baseline results of the borrower fixed-effects and industry-by-year fixed effects for loan spreads. The estimates using the borrower's credit ratings in columns (1) and (3) indicate that less risky firms with higher credit ratings obtain lower loan spreads. The results in column (3) become slightly stronger by including industry-by-year fixed effects, which control unobserved and time-varying differences across industries in which the borrower operates as well as borrower fixed effects.[8]

[Table 2 around here]

When using the financial indicators of the borrower, risky borrowers with higher volatility pay a higher loan spread, and borrowers with larger total assets obtain lower loan spreads. In all specifications (1)–(4), the estimated coefficient on *Tenor* is significantly positive at the 1% level with a premium for lengthy maturity. Syndication size, *No. of Lenders*, seems less likely to emerge from the pricing term. Given the strength of the bank-firm relationships in Japan, one might be concerned about the certification effect of the main bank arranger or the endogeneity. Subsequently, Appendix A tests for the endogeneity of *Main Bank Arranger*.

4.2 Maturity

Table 3 reports the baseline results including the borrower fixed-effects and industry-by-year fixed effects for loan maturity. Columns (1) and (3) use rating information to demonstrate that

[8] Observations in the specifications with only borrower fixed effects and both borrower fixed effects and industry-by-year fixed effects differ because we drop singleton groups, which can overstate statistical significance and might lead to an incorrect inference.

the relationship between credit risk and maturity seems more complicated than expected. The theoretical implications demonstrated in previous studies support the negative correlation between maturity and credit rating; that is, maturity increases as the credit rating worsens, or only very low-risk and high-risk firms borrow short-term debt. No clear relationship is observed between credit rating and loan maturity.

[Table 3 around here]

The results of the borrower's financial indicators in columns (2) and (3) demonstrate that borrowers with higher *Sales growth* tend to prefer long-term borrowing, which is consistent with the anticipated relationship that firms with an expanding business attempt to use long-term borrowing to avoid the liquidation risk of losing their business. On the other hand, borrowers with higher *EBITDA growth* prefer short-term credit. Previous theoretical studies suggest that firms with growing profits are more likely to use short-term borrowing because they can lower their borrowing costs following good news about their profitability after refinancing in the near future, assuming asymmetric information; that is, the firm is better informed about its own prospects. The negative estimated coefficient on *EBITDA growth* supports this theoretical implication.

Estimates in columns (1)–(3) indicate that the number of lenders (or the syndication size) is associated with short-term borrowing. Longer-term borrowing involves more risk and uncertainty than shorter-term borrowing, which might be because few lenders are willing to become involved in syndication for long-term borrowing. The maturity of a subordinated loan would seem much longer than other seniority-type loans, indicating that this type of loan can have equity credit attributes.

4.3 Credit supply conditions and loan contracts

Business cycle risk is an important risk factor for both lenders and borrowers, as the chief financial officers (CFO) survey evidence in Graham & Harvey (2001) demonstrates. The cyclical nature of debt and debt maturity is associated with economic activity as investigated by Emery (2001), Becker & Ivashina (2014) among others. Following previous studies, in order to examine how borrowers and lenders adjust their debt to economic fluctuations, we add two macroeconomic control variables relating to macroeconomic growth and credit supply conditions. These control variables are monthly time-series variables and are not borrower specific.

The first variable is *Economic expansion*, measured as the Coincident Index (CI) growth rate. This is an index of Business Conditions, published monthly by the Cabinet Office, Government

of Japan. The impact of business conditions on the contract is multifaceted. For example, firms attempt to avoid higher interest costs in bad times, or in a worse scenario, they are forced to shrink or forgo their business investments. Borrowers are assumed here to take account of the liquidity risk and time their borrowing, and they are expected to borrow short-term debt in good times when the probability of the good news about their future prospects is high, and they can refinance at a lower interest rate. Nonetheless, the economic downturn induces the opposite force, as lenders are unwilling to lend in the long-term because of the higher probability of risk, and subsequently, lenders want to provide short-term debts in bad times. For the loan spread, the risk environment depends on the economic conditions. In good times, on average, the risk is low, and profit is rising. As this environment leads to lower spreads, a decrease in loan spread is expected.

Another control variable is *Lending attitude*, to capture the credit supply condition. As the credit supply condition is more apparent in lending attitudes towards small firms, we use the variable *Lending attitude*, which is a statistical survey response about the lending attitude of financial institutions for small enterprises in $Tankan$ (Short-term Economic Survey of Enterprises in Japan), conducted quarterly by the BOJ. For *Lending attitude*, small enterprises are asked to choose the most appropriate answer from three alternatives, (1) Accommodative, (2) Not so severe, and (3) Severe. The responses are aggregated into a Diffusion Index (percent points) by subtracting the percentage share of enterprises responding "(3) Severe" from that of enterprises responding "(1) Accommodative." We expect negative estimated coefficients on *Lending attitude* in loan spread and maturity because the increase in the value of this variable implies an improvement in business confidence.

Given the important role of arranger banks in a syndicated loan contract, we further absorb time-varying and unobserved (arranger) bank heterogeneity, which stems from the bank balance-sheet channels with (arranger) bank-by-year fixed effects. Thus, we adequately isolate the loan demand factors from loan supply side factors, and this allows us to identify the effects of monetary policy through the expected market interest rate channel at the firm level in the following section.

4.3.1 Spreads

Table 4 provides the results for the loan spread with these macroeconomic control variables and bank-by-year fixed effects in addition to borrower fixed effects and two-digit NAICS industry-by-year fixed effects. Note that the two macroeconomic control variables are far from highly

correlated. We begin with the borrower fixed effects specifications (1) and (2) to demonstrate that dropping some firms from the regression sample through the inclusion of many fixed effects is not the source of the results.

Although the estimated coefficients on *Economic expansion* are not significant in any specification, the estimated coefficients on *Lending attitude* are as expected and significant in all specifications. This result indicates that the business confidence is relevant to loan spreads.

Specifications (3) and (4) additionally contain bank-by-year fixed effects and two-digit NAICS industry-by-year fixed effects. The results in (1)–(4) always suggest that the less risky borrowers obtain lower loan spreads, but it is more evident in (3) and (4) with bank-by-year fixed effects and two-digit NAICS industry-by-year fixed effects.

4.3.2 Maturity

In addition to the two macroeconomic control variables, we included the variable *Economic expansion* $\times$ *Total Debt to EBITDA* to test the degree of borrower's financial flexibility over the business cycle for the loan maturity models. The results in Table 5 demonstrate that the estimated coefficients on *Lending attitude* are not significant, suggesting that on average, business confidence is not relevant to loan maturity. In contrast, they provide weak evidence that *Economic expansion* and *Economic expansion* $\times$ *Total Debt to EBITDA* are associated with long-term borrowing. The borrowers seem to take advantage of the low-risk environment to lock-in long-term debt and avoid liquidity risk, and borrowers with higher *Total Debt to EBITDA* whose increase makes the risk associated with financial hardships grow, resulting in a lowering of their financial flexibility, take more advantage of the economic expansion to reduce their liquidity risk.

In the subsequent section, we identify the monetary policy shocks and estimate the effects of monetary policy shocks on the loan spread and loan maturity with the most saturated specification in this section.

[Tables 4 and 5 around here]

5 Identification of Unconventional Monetary Policy Shocks and Loan Contracts

During the sample period studied in this analysis, the monetary policy was almost stuck at the zero bound in Japan. As Wright (2012) notes, the bank rate, the federal fund rate in his paper, measures the monetary policy stance during normal times when the bank rate is not stuck at the zero bound (more precisely, in a target range from zero to 25 basis points). However, a single measure of the overall monetary policy stance cannot be found when the bank rate is close to, or pushed to, the zero bound, especially through unconventional monetary policy, including forward rate guidance, asset purchases, and QQE programs. Instead, the idea of measuring monetary policy shocks from the reaction of the asset prices traded in financial markets has been suggested and employed in the literature; for example, see Cook & Hahn (1989), Gürkaynak et al. (2005b), Wright (2012), and Rogers et al. (2014). The measurement of monetary policy shocks remains a challenge. Extracting the first principal component of yields for Treasury futures at different maturities is one method adopted in previous studies. For Japan, the BOJ adopted various unprecedented monetary policies since the end of the 1990s, such as a zero interest rate policy, forward guidance, the quantitative easing policy, and QQE;[9]. Hence, we attempted to find a way to fit these circumstances in our sample period. As discussed in detail below, we used various financial asset variables based on the findings of researchers such as Bernanke & Kuttner (2005), Gürkaynak et al. (2005a), and Gertler & Karadi (2015) to compute the BOJ's monetary policy shocks.

More concretely, following Cook & Hahn (1989), Wright (2012), Rogers et al. (2014), and Gertler & Karadi (2015), we assumed that policy shocks reflect the changes in asset prices as market participants revise their expectations after policy decisions are announced following monetary policy meetings. We can consider the revised expectations of financial market participants that are induced by a central bank's public statements or policy decisions as monetary policy shocks.

While previous studies have focused on the changes in short-term interest futures, we allowed for all the surprises reflected in the price changes observed in the various financial markets. This is partly because the short-term interest rates in Japan hardly changed under the unconventional monetary policy, and partly because the BOJ introduced different policy measures that directly affect financial markets other than short-term interest rates.

[9] see Kuroda (2016) for the details of unconventional monetary policies.

More precisely, we extracted the common factors in various financial assets through principal component analysis following Bernanke et al. (2004) and Gürkaynak et al. (2005a).[10] We extracted as common factors the policy surprises in the changes in the major financial market variables following public statements. The principal component analysis of monetary policy on meeting day t is based on the following equation:

$$\mathbf{X_t} = \mathbf{\Lambda F_t} + \epsilon_\mathbf{t}, \tag{3}$$

where $\mathbf{X_t} = (x_{1t}, .., x_{nt})'$ denotes the vector of n financial variables, $\epsilon_\mathbf{t}$ indicates the vector of n idiosyncratic disturbance terms, $\mathbf{F_t}$ is the vector of l unobserved common factors, and $\mathbf{\Lambda}$ is a matrix of coefficients identified as factor loadings. We extracted the common factors $\mathbf{F_t}$ from changes in 11 financial market variables x_{it} $(i = 1, .., 11)$: one futures rate (three-month euro-yen TIBOR futures), five yen interest swap rates (one, two, five, ten, and thirty years), one short-term spot rate (three-month euro-yen TIBOR), two spot exchange rates on the Tokyo market (yen-U.S. dollar and yen-AUS dollar), and two stock indexes (TOPIX and Nikkei JASDAQ).

We calculated the differences in seven interest rate variables, the log differences of exchange rates, and the stock indexes before and after public statements.[11] Note that the stock markets close at 3:00 p.m. and the BOJ usually holds a press conference at 3:30 p.m., after the monetary policy meeting, where its governor coveys the background of the policy decisions. Under the unconventional monetary policy regime, where the BOJ introduced various new measures simultaneously, market participants could not analyze and digest the policy measure effects on financial markets immediately after the conference. In such a situation, they could not use the BOJ's explanations at the press conference and reflect it in their prices.[12] Against this background, we used the closing values on the day before the BOJ's public statements and on the next day to calculate the changes in the 11 financial variables. More concretely, for stock prices and exchange rates, x_{it} is defined as

$$x_{it} = \log(P_{it+1,close}/P_{it-1,close}) \times 100, \tag{4}$$

[10] Gürkaynak et al. (2005a) point out that the primary alternative to principal components is Kalman filtering, which is optimal under the assumption of normally distributed residuals, and the normality assumption may not fit their data very well. This statement also applies to our data.

[11] To extract the monetary policy shocks, we used the changes in financial market variables on all of the monetary policy meeting days, except the days mentioned in the footnote 13. For detailed information on the monetary policy meeting days and policy decisions, see the following BOJ website: https://www.boj.or.jp/en/mopo/mpmsche_minu/index.htm/

[12] For a more detailed discussion on the appropriate window for calculating monetary policy surprises, see Neely (2015), for example.

and for interest rates, it is defined as

$$x_{it} = r_{it+1,close} - r_{it-1,close}, \tag{5}$$

where $P_{it+1,close}$ and $P_{it-1,close}$ indicate the closing values of the exchange rates and stock indexes on the day after a monetary policy meeting and on the previous day, respectively. $r_{it+1,close}$ and $r_{it-1,close}$ denote the opening and closing interest rates, respectively.

We excluded the meeting dates when the BOJ coordinated policy with the Fed, the European Central Bank, and the Bank of England as well as the dates when the BOJ changed its policy in response to the Great East Japan Earthquake on March 11, 2011. The inclusion of these policy meeting dates could contaminate our monetary policy shocks by reflecting other shocks such as other central banks' policy shocks, policy coordination, and disasters.[13]

To select the number of common factors, we employed the information criteria method proposed by Bai & Ng (2002) and Ahn & Horenstein (2013). These tests suggest that the principal components from the largest eigenvalues are three, and thus endorse adopting three common factors as the monetary policy shocks captured by the eleven financial variables. When constructing the monthly data of policy surprises, we aggregated the two datasets of the three common factors if the BOJ's monetary policy meeting is held twice per month.

5.1 The factors of the monetary policy shocks

We extracted three principal components along with the three largest eigenvalues from the changes in 11 financial asset variables, as illustrated in Figure 3. The first component has slightly negative loadings on stock price returns and yen exchange rates, suggesting that the positive first component is associated with the decline in stock prices and appreciation of yen. On the other hand, the first component has positive loadings on the changes in interest rates. The size of loadings for swap rates is almost the same across the different interest rate swap time horizons, suggesting that the first component captures a parallel shift of the yield curve. From the viewpoint of monetary policy implementation and the market participants' response, the first component reflects an unanticipated increase in the policy rate, shifting the entire path of the future policy rate while slightly decreasing stock prices. We call the first component *target interest rate shock*. In fact, in Appendix

[13]The following meeting dates are excluded: September 18 and 29, 2008; November 30, 2011 (BOJ meetings to coordinate policy); and March 14, 2011 (the meeting where the BOJ's response to the Great East Japan Earthquake was agreed upon).

B, using a Structural Vector Autoregressive (SVAR) model, we demonstrate that a positive *target interest rate shock* increases the interest rates in all maturity levels, thereby shifting up the entire yield curve.

[Figure 3 around here]

The second component has large positive loadings on stock prices, exchange rates, and swap rates in the longer horizon, but negative loadings on short-term interest rates. In other words, a positive second component reflects an unexpected decrease in short-term rates, which leads to increases in the prices of risky assets. Furthermore, note that a positive shock of the second component is associated with decreases in short-term rates and positively associated with an increase in long-term rates. One of the possible interpretations for this pattern of loadings is that when this component is positive, market participants expect the interest rate in the longer horizon to increase, although the BOJ conducts an accommodative monetary policy temporarily. A temporarily accommodative policy can be interpreted as a stimulus policy, which leads to an increase in the future short-term rate. In fact, the development of the second component illustrated in Figure 4 alongside the evolution of the BOJ's monetary policy indicates that it peaked when the BOJ introduced a negative interest rate in January 2016. This component is called *steepening curve shock* in this study. In Appendix B, based on the SVAR model, we demonstrate that a positive *steepening curve shock* decreases short-term interest rates and increases long-term rates without altering the current account balances very much.

[Figure 4 around here]

The third component has positive loading on stock returns, swap rates in the short horizon, and exchange rate returns, but negative loadings on swap rates in the longer horizon. Although the second and third components have positive loading on stock returns, the third component captures a different type of monetary policy shock compared to the second one because it has opposite signs of loadings on swap rates in the short and long horizons. For example, the positive third component is associated with a decrease in long-term interest rates as well as increases in risky asset prices. We can interpret that it captures the unconventional policy of lower interest rates in the long-term horizon and increases in risky asset prices. We refer to the third component as *expansionary twist shock*.

In the analysis of spread models, we used monthly monetary policy shocks, whereas quarterly monthly policy shocks are used in the maturity models. The contract terms of syndicated loans are made in the process of negotiation, and the monthly frequency is long enough for the lender and the borrower to interpret the monetary policy statements and decisions, and to then decide the pricing term, observing the movement of TIBOR and the demand of investors. Nevertheless, maturity is an important factor affecting various borrowers' corporate strategies, including financing and investment. In particular, unconventional monetary policy measures are beyond the conventional interpretation even for managers, and it would take some time for the borrower to interpret and forecast the interest rate movements for implementing the scheduled investment. We aggregated the monthly policy shock data and used the quarterly monetary policy shock variables in the maturity models.[14] The impulse responses of the short and long-term rates to the *expansionary twist shock* indicate that it increases short-term rates but decreases long-term rates. In addition, it increases the current account balances while the *steepening curve shock* has little effect on them. This result implies that the *expansionary twist shock* induces a change in the BOJ's balance sheet by purchasing long-term bonds more aggressively. Interestingly, it increases the stock prices and the U.S. dollar-yen exchange rates. Furthermore, the impulse response of the inflation rate to the *expansionary twist shock* indicates its positive effects.

We are now interested in the coefficients of the *target interest rate shock*, *steepening curve shock*, and *expansionary twist shock*. Our estimates reported in columns (1) and (2) of Table 6 address the responses to monetary policy shocks using three components. The results in column (1) indicate that a *target interest rate shock* and an *expansionary twist shock* tend to increase the loan spread, but a *steepening curve shock* significantly decreases the loan spread. The differences in these responses coincide with the direction of loadings on the changes in interest rates in short horizons, that is, positive *target interest rate shock* and *expansionary twist shock* are associated with an increase in the short-term interest rates while a positive *steepening curve shock* is associated with a decrease in the short-term interest rate. Results in column (2), conditional on rating information, demonstrate that the coefficients of three monetary policy shocks are not significant. Hence, we found weak evidence for the expected market interest channel of monetary policy effects on the loan spreads.

Columns (1) and (2) of Table 7 demonstrate the monetary policy shock effects on loan matu-

[14]The monetary policy shock variables are not correlated with macroeconomic control variables.

rity. A *target interest rate shock* and an *expansionary twist shock* significantly induce borrowers to prefer short-term borrowing. On the contrary, a *steepening curve shock* tends to make borrower prefer long-term borrowing. These results hold both in columns (1) conditional on rating information and (2) conditional on the borrower's financial indicators, indicating that we find significant responses of borrowers to the monetary policy shocks in their loan maturity choices through the expected market interest rate channel.

Although the sign of coefficients on the *target interest rate shock* and the *expansionary twist shock* are both negative, we considered the different impact of each monetary policy shock behind this response. The *target interest rate shock* captures a parallel shift (up) of the yield curve, which implies an increase in the cost of borrowing on all maturities. In this situation, borrowers can presume upward pressure on borrowing costs related to the premiums on loans and prefer short-term borrowing. As explained earlier, an *expansionary twist shock* is associated with a decrease in long-term interest rates. Graham & Harvey (2001) demonstrate that corporate executives attempt to time their interest rates and borrow short-term debt when they expect long-term rates to decline. Assuming this also holds in Japan, the expectation induced by an *expansionary twist shock* that the long-term rate would decline induces the borrower to prefer short-term debt to time the market.

[Tables 6 and 7 around here]

5.2 The differential effects of monetary policy shocks

So far, we obtained our results assuming that the responses of borrowers to monetary policy shocks are uniform, but each borrower's creditworthiness and financial constraints might differ, leading to different debt finance policies for borrowers. The unconventional monetary policy, including those in the United States and Europe, lowered the entire yield curve in all debt markets. As a consequence of the (ultra-) loose monetary policy in many places, a lower fund-raising cost offers borrowers more options for their debt choices, such as jumbo loans, ultra-long-term hybrid loans, and perpetual subordinated bonds; otherwise, the fund-raising costs for these debt types would be too high. Moreover, using U.S. data, Becker & Ivashina (2014) demonstrate that the firms that cannot access the public bond market are most likely to be affected by bank-credit supply. Given the varying accessibility to debt markets, we compared the results for firms who have access to the bond market with firms without access to the bond market.

From the descriptive statistics in Table 1, about 30% of the observed 28,586 tranches in the Thomson Reuter LPC DealScan are issued by borrowers who have rating information available, and 40% of the observations are issued by borrowers whose financial indicators are publicly available. Thus, borrowers have quite different sensitivities to the monetary policy shocks stemming from different financial constraints. One reason for this is that no credit rating implies a reduced availability of public information, which could signal the root of risk for investors. These borrowers seem riskier or entail closer monitoring for creditors compared to those with public rating information. Another reason is that the absence of a high-yield bonds market, which can be found in the United States, allows for only corporate bonds rated above an investment grade, that is, above BBB-rated, to be issued in the Japanese straight corporate bonds market. Therefore, borrowers with the BBB rating or higher can access the corporate bond market, while the rest of the borrowers have no access. One might believe that banks are the major players in Japanese corporate finance, and so accessibility to bond markets is not important given the critical presence of banks in corporate finance. However, more firms with access to the public bond market are becoming global companies, with more than half of their net sales generated from international business. This implies that firms that tap into the offshore market are the least financially constrained and that the domestic bank credit conditions do not affect their debt financing as crucially as it does those who cannot access the public bond market. For instance, after the recent turbulent conditions brought about by the BOJ's unconventional monetary policy in the bond market, the issue amounts of corporate bonds increased substantially in 2016 owing to low bond yields. However, borrowers below the BB rating or with no public rating could not access the bond market with these record low yields. Although the substitution between bank loans and public corporate bonds is not the focus of this study,[15] we expect the borrowers with access and without access to bonds to face different financial constraints.

This subsection explores whether the responses to monetary policy shocks are uniform for borrowers by dividing our sample into two groups: borrowers with access and those without access to the public corporate bond market. We expect the borrowers with access to bond markets to be more sensitive to monetary policy shocks in order to time their borrowing because they are less financially constrained and have more financing options. The empirical literature, for example,

[15] We would have to restrict the borrowers who have access to the bond market by eliminating about two-thirds of observations in order to analyze the substitution between bank loans and public corporate bonds, and so we would have to incorporate this topic into a separate paper about corporate debt choice.

Faulkender (2005) and Graham & Harvey (2001) among others, suggests that CFOs try to time the market, that is, to time the interest rates. Graham & Harvey (2001) state that it is important in particular for large firms, which are more likely to have a sophisticated treasury department, to time the market interest rates. Thus, we expect borrowers with access to bonds to be more sensitive to monetary policy shocks, assuming that they are relatively larger firms with more financing options, and then the maturity for borrowers with access to bonds is more likely to be affected by monetary policy shocks to time the market interests.

Columns (3)–(5) of Table 6 provide the estimates on the loan spread factors for borrower groups with access and without access to bonds, respectively. Most of the borrowers without access to bonds do not have publicly available information about their financial health. This means that these borrowers are more likely to depend on the internal risk assessments that the banks assign to these borrowers, and hence, the loan spread factors for these are different from those who have access to bonds. However, the estimated coefficients on monetary policy shocks for both groups are insignificant, and there is little to support the idea that the responses to monetary policy shocks differ between these two groups.

The results in columns (3)–(4) of Table 7 relate to the borrowers with access to bonds who are assumed to face fewer financial constraints than those without access to bonds. Less financially constrained borrowers are considered to face fewer liquidity risks and choose a debt maturity to time the market, believing that their prediction about the interest rate movements can lower their fund-raising costs. Consistent with our assumption, the response to the *expansionary twist shock* of borrowers with access to bonds is statistically significant at the 1% level for each specification in columns (3) and (4). On the other hand, the responses of borrowers with no access to bonds illustrated in columns (5) and (6) are not statistically significant. An *expansionary twist shock* is associated with a decrease in long-term interest rates, and the negative estimated coefficients of this variable suggest that borrowers with access to bonds are more likely to time the market by borrowing short-term when they expect the long-term rates to decline. We find statistically significant evidence of monetary policy effects on the financial policies of firms through the expected market interest rate channel, and the effects differ across borrowers with different financial constraints.

6 Conclusion

This study investigated the effects of monetary policy on the financing policies of firms through the expected market interest rate channel at the firm level, using Japanese syndicated loan contracts from 2000 to 2016, when the monetary policy was almost stuck at the zero bound in Japan and the BOJ introduced many unconventional monetary policy measures such as forward rate guidance, asset purchase programs, and QQE programs. By identifying the unconventional monetary policy shocks from the reaction of the asset prices, we attempt to measure the monetary policy shocks in the absence of a single measure of (unconventional) monetary policy stance during the sample period. Since the Japanese syndicated loan market is almost dominated by banks, as illustrated in Section 2, it might appear natural for bank loans to be affected by the monetary policy, given its transmission mechanism. Nevertheless, the monetary policy effects seem to be unclear. On the borrower's side, several Japanese firms are reported to be cash-rich, and the firms still accumulate cash after the global financial crisis. For our purpose, we control for both observed and unobserved firm heterogeneity and unobserved time-varying bank heterogeneity in loan contracts.

We found that an *expansionary twist shock*, associated with a decrease in long-term interest rates, exerts influence particularly on the non-pricing term (maturity) of loan contracts. We further examined the effects of monetary policy shocks from the borrower's financial constraints perspective. We found a significant response to monetary policy shocks associated with a decrease in long-term interest rates only for the borrower group with access to bonds. This implies that firms with access to bonds attempt to time the market in the belief that their prediction of interest rate movements can lower their fundraising costs. This is consistent with evidence from previous studies in the United States based on a survey of financial executives. However, the response of borrowers who do not have access to the bond market is not significant, implying the loan contracts of these borrowers seem more likely to depend on the internal risk assessment that banks assign. In sum, monetary policy affects the maturity of loans, in particular for the less financially constrained borrowers, through the expected market interest rate channel.

While the conventional means of stimulating the aggregate demand is no longer feasible when the monetary policy is stuck at zero, the central banks of many countries introduced a variety of communications to inform the public about their policy. Evidence presented in this study indicates that their communication strategy could affect the investment financing policies of firms. Their

communication designed to help shape the public expectations of future policy was found to have played an important role in the borrowing decisions of firms. Moreover, when the central banks of several countries are about to exit from their unconventional monetary policy measures, our estimation results imply that the BOJ's communication strategy to provide clear information about the likely direction of future policies would become even more important in the financing policies of firms, even though they may be very challenging.

Natural extensions of our study include the effects of monetary policy on the composition of debt, as a ratio of bank loans and corporate bonds. We reviewed bank loans, but the firm decides its financing policies for the optimal debt structure. For borrowers having access to bonds, they choose the debt structure simultaneously. When the costs of bank loans and bonds issued are affected by monetary policy, the debt structure of firms also changes. In addition, the effect of monetary policy on the relation between the composition of debt and firm investment is an interesting area of work for the future. The borrowing and investment choices of firms require different datasets, and this topic remains for future research.

Appendix A. The Endogeneity of Main Bank Outcomes

Given the strong bank-firm relationship in Japan, one might be concerned about the certification effect of main bank arrangers when the loan is arranged by the borrower's main bank. That is, if the main bank certification effect exists, the spread for a loan arranged by the borrower's main bank is lower, holding other factors that could affect the spread constant, due to the bank's superior access to private inside information on the borrower based on their long-term relationship and more efficient monitoring.

To investigate the robustness of our results, we test whether *Main Bank Arranger* is determined endogenously. That is, unobserved factors, such as certain characteristics of a borrower, are suspected to affect both the probability of choosing the main bank as a lead arranger and spread levels. The approach to the test is that both the predicted probabilities from a probit model for *Main Bank Arranger* which is a 0-1 dummy variable taking the value of unity when the borrower's main bank is a lead arranger and zero otherwise, and $Spread$ are estimated by a maximum likelihood estimator. We identify the main bank, which is listed first, from among the firm's reference banks in the latest issue of Japan company handbook (quarterly) immediately before each loan origination.

For the model to explain the choice of *Main Bank Arranger*, we use the HHI for the lead ar-

ranger market and the indicator for whether a borrower is a listed company as explanatory variables in a probit model. We test another specification using the HHI and the rating information as explanatory variables in a probit model. The key results are that the estimated correlation between the errors from these equations is -0.15, which is not significantly different from 0 (p-value is 0.16). That is, the endogeneity of *Main Bank Arranger* can be ruled out as contributing to our results.

Appendix B. The Effects of Monetary Policy Shocks on Economy

In this appendix, we demonstrate the effects of three monetary policy shocks on the economy using the SVAR model in order to obtain a deeper understanding of the estimation result for the maturity and spread model discussed in Section 5. We follow the strand of literature that exploits the instrumental variable approach and combines a shock from micro-data with a VAR model to identify the effect of a shock on the economy (see for example Stock & Watson (2012)). More concretely, we assume that the dynamics of financial and macroeconomic variables, which are denoted by $n \times 1$ vector Y_t, is approximated by a VAR system with p number of lags as follows:

$$Y_t = \sum_{p=1}^{P} \beta_p Y_{t-p} + \nu_t, \tag{6}$$

where ν_t denotes reduced form shocks of the VAR system. We assume that ν_t is represented by a linear combination of some fundamental shocks, μ_t: I.e. we assume that $\nu_t = B\mu_t$ holds with $n \times n$ matrix B. Without loss of generality, we assume that the three monetary policy surprises are defined as the first three elements of vector μ_t. Moreover, we define Σ_μ as a variance-covariance matrix of the fundamental shocks μ_t as follows,

$$E(\mu_t \mu_t') = \Sigma_\mu = D \tag{7}$$

where D is a $n \times n$ diagonal matrix.

Using the identified three column vectors b_i (i=1,2,3) in matrix B, we can calculate the impulse response functions (IRFs), IRF_{hi}, to monetary policy shock i in time horizon h as follows,

$$IRF_{hi} = \psi_h b_i \tag{8}$$

where ψ_h denotes the impulse response function to non-orthogonalized shocks for horizon h in reduced form of the VAR model.

As endogenous variables in the SVAR, we include the eight financial market variables, two macroeconomic variables, and the current account balances (CABs). The eight financial variables consist of the monthly change rates of yen-U.S. dollar exchange rate, the NIKKEI225 stock index, and the monthly changes of the three-month TIBOR future, and one-year, two-year, five-year, ten-year, and 30-year swap rates. The monthly growth rate of the aggregate current account balances of banks is included in order to capture the unconventional monetary policy where the BOJ expands its balance sheet. The two macroeconomic variables include the monthly growth rate of the consumption price index (CPI; less foods and energy, adjusted for the consumption tax increases) and Indices of Industrial Production (IIP). Both are seasonally adjusted before the calculation of the growth rate. All the variables are illustrated as a percentage base. The length of the lag in the SVAR model is chosen as one based on the AIC. Our monthly dataset is from January 2000 until December 2016.

To estimate the VAR model, we used the bootstrap method by resampling 3,000 times. Figure B1 illustrates the IRFs to a positive *target interest rate shock* of one standard deviation, indicating that a positive shock shifts the entire yields curve upwards. Furthermore, it decreases the current account balance although it increases slightly for the first few months. The CPI inflation rate and the IIP decrease although they are not statistically significant. The result implies that the *target interest rate shock* captures the conventional monetary policy shock, which affects the economy through the level of interest rates in all maturities.

Figure B2 illustrates that a positive *steepening curve shock* decreases short-term rates and increases long-term rates. However, it does not significantly change the CAB although the CAB gradually increases after the shock hits the economy. Furthermore, the CPI inflation rate decreases while the IIP increases. In this paper, the real effects of unconventional monetary policy are not our focus. The growing literature suggests the definition of unconventional monetary policy shocks and a method of identifying them (see, for example, Swanson (2015) and Nakashima et al. (2018)). However, there is still no consensus for the definition and methodology. Hence, here we only provide some possible hypotheses. One explanation is that in a low interest environment, a tiny decrease in short-term rates without changing the central bank's balance sheet is not so effective that the inflation expectation does not change, although it stimulates production temporarily. Instead, because the central bank has private information that other agents do not, it signals the information to the other agents that the inflation would be lower than previously expected through the

implementation of the monetary policy.[16]

Finally, Figure B3 illustrates that a positive *expansionary twist shock* increases short-term rates while it decreases long-term rates. In addition, it increases the CAB substantially by stimulating the inflation rate and production. In others words, the estimation results imply that the *expansionary twist shock* stimulates the economy by purchasing long-term bonds and expanding its balance sheet. Given this backdrop, we can reinterpret the results for the impact of the *expansionary twist shock* on the loan maturity in Section 5; the *expansionary twist shock* increases output, thereby reducing the incentive of firms to raise funds for precautionary motives.

References

Ahn, Seung C. & Alex R. Horenstein. 2013. Eigenvalue ratio test for the number of factors. *Econometrica* 81(3). 1203–1227.

Aoki, Masahiko, Hugh Patrick & Paul Sheard. 1994. The Japanese main bank system: An introductory overview. In M. Aoki & Hugh Patrick (eds.), *The Japanese main bank system: Its relevance for developing and transforming economies*, 3–50. Oxford: Oxford University Press.

Bai, Jushan & Serena Ng. 2002. Determining the number of factors in approximate factor models. *Econometrica* 70(1). 191–221.

Barnea, Amir, Robert. A. Haugen & Lemma W. Senbet. 1980. A rationale for debt maturity structure and call provisions in the agency theoretic framework. *Journal of Finance* 35(5). 1223–1234.

Becker, Bo & Victoria Ivashina. 2014. Cyclicality of credit supply: Firm level evidence. *Journal of Monetary Economics* 62. 76–93.

Bernanke, Ben S. & Alan S. Blinder. 1992. The federal funds rate and the channels of monetary transmission. *American Economic Review* 82(4). 901–921.

Bernanke, Ben S. & Kenneth N. Kuttner. 2005. What explains the stock market's reaction to federal reserve policy? *Journal of Finance* 60(3). 1221–1257.

Bernanke, Ben S., Vincent R. Reinhart & Brian P. Sack. 2004. Monetary policy alternatives at the zero bound: An empirical assessment. *Brookings Papers on Economic Activity* 2. 1–100.

[16]For the detailed discussion of the signaling channel of monetary policy shocks, see Romer & Romer (2000).

Brick, Ivan E. & S. Abraham Ravid. 1985. On the relevance of debt maturity structure. *Journal of Finance* 40(5). 1423–1437.

Cook, Timothy & Thomas Hahn. 1989. The effect of changes in the federal funds rate target on market interest rates in the 1970s. *Journal of Monetary Economics* 24(3). 331–351.

Custódio, Cláudia, Miguel A. Ferreira & Luís Laureano. 2013. Why are US firms using more short-term debt? *Journal of Financial Economics* 108(1). 182–212.

Diamond, Douglas W. 1991. Debt maturity structure and liquidity risk. *Quarterly Journal of Economics* 106(3). 709–737.

Emery, Kenneth M. 2001. Cyclical demand and the choice of debt maturity. *Journal of Business* 74(4). 557–590.

Fan, Joseph P.H., Sheridan Titman & Gary Twite. 2012. An international comparison of capital structure and debt maturity choices. *Journal of Financial and Quantitative Analysis* 47(1). 23–56.

Faulkender, Michael. 2005. Hedging or market timing? Selecting the interest rate exposure of corporate debt. *Journal of Finance* 60(2). 931–962.

Flannery, Mark J. 1986. Asymmetric information and risky debt maturity choice. *Journal of Finance* 41(1). 19–37.

Fukuda, Shin-ichi, Ji Cong & Akihiro Nakamura. 1998. Determinants of long-term loans: a theory and empirical evidence in Japan. *Journal of Multinational Financial Management* 8(2-3). 113–135.

Gertler, Mark & Peter Karadi. 2015. Monetary policy surprises, credit costs, and economic activity. *American Economic Journal: Macroeconomics* 7(1). 44–76.

Graham, John R. & Campbell R. Harvey. 2001. The theory and practice of corporate finance: evidence from the field. *Journal of Financial Economics* 60(2-3). 187–243.

Guedes, Jose & Tim Opler. 1996. The determinants of the maturity of corporate debt issues. *Journal of Finance* 51(5). 1809–1833.

Gürkaynak, Refet S., Brian Sack & Eric T. Swanson. 2005a. Do actions speak louder than words? The response of asset prices to monetary policy actions and statement. *International Journal of Central Banking* 1(1). 55–93.

Gürkaynak, Refet S., Brian Sack & Eric T. Swanson. 2005b. The sensitivity of long-term interest

rates to economic news: Evidence and implications for macroeconomic models. *American Economic Review* 95(1). 425–436.

Hirano, Hidenori. 2007. *Yokuwakaru shinjikêto rôn (practical guide to syndicated loans)*. Tokyo: Kinzai Institute for Financial Affairs, Inc. (in Japanese).

Hoshi, Takeo & Anil K. Kashyap. 2001. *Corporate financing and governance in Japan: The road to the future*. Cambridge, MA, and London: MIT Press.

Hoshi, Takeo & Anil K Kashyap. 2004. Japan's financial crisis and economic stagnation. *The Journal of Economic Perspectives* 18(1). 3–26.

Ivashina, Victoria. 2009. Asymmetric information effects on loan spreads. *Journal of Financial Economics* 92(2). 300–319.

Japan company handbook. quarterly. Tokyo: Toyo Keizai, Inc.

Jiménez, Gabriel, Steven Ongena, José-Luis Peydró & Jesús Saurina. 2012. Credit supply and monetary policy: Identifying the bank balance-sheet channel with loan applications. *American Economic Review* 102(5). 2301–2326.

Jiménez, Gabriel, Steven Ongena, José-Luis Peydró & Jesús Saurina. 2014. Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking? *Econometrica* 82(2). 463–505.

Kashyap, Anil K & Jeremy C Stein. 2000. What do a million observations on banks say about the transmission of monetary policy? *American Economic Review* 90(3). 407–428.

Khwaja, Asim Ijaz & Atif Mian. 2008. Tracing the impact of bank liquidity shocks: Evidence from an emerging market. *American Economic Review* 98(4). 1413–1442.

Kuroda, Haruhiko. 2016. The practice and theory of unconventional monetary policy. In Joseph E. Stiglitz & Martin Guzman (eds.), *Contemporary issues in macroeconomics: Lessons from the crisis and beyond*, chap. 1, 7–14. Amsterdam: Palgrave Macmillan.

Lim, Jongha, Bernadette A. Minton & Michael S. Weisbach. 2014. Syndicated loan spreads and the composition of the syndicate. *Journal of Financial Economics* 111(1). 45–69.

Myers, Stewart C. 1977. Determinants of corporate borrowing. *Journal of Financial Economics* 5(2). 147–175.

Nakashima, Kiyotaka, Masahiko Shibamoto & Koji Takahashi. 2018. Identifying unconventional monetary policy shocks. Working paper.

Neely, Christopher J. 2015. Unconventional monetary policy had large international effects. *Journal of Banking & Finance* 52. 101–111.

Peek, Joe & Eric S. Rosengren. 2005. Unnatural selection: Perverse incentives and the misallocation of credit in Japan. *American Economic Review* 95(4). 1144–1166.

Rogers, John H., Chiara Scotti & Jonathan H. Wright. 2014. Evaluating asset-market effects of unconventional monetary policy: a multi-country review. *Economic Policy* 29(80). 749–799.

Romer, Christina D & David H Romer. 2000. Federal reserve information and the behavior of interest rates. *American Economic Review* 90(3). 429–457.

Shin, G.H. & J.W. Kolari. 2004. Do some lenders have information advantages? Evidence from Japanese credit market data. *Journal of Banking and Finance* 28(10). 2331–2351.

Stock, James H & Mark W Watson. 2012. Disentangling the channels of the 2007-2009 recession. *Brookings Papers on Economic Activity* Spring. 81–135.

Sugahara, Masaharu, Sawako Miyauchi Hajime Kanagawa & Akira Marumo. 2007. In Masanori Sato (ed.), *Shinjikêto rôn no jitsumu (practical guide to syndicated loan transaction)*, Tokyo: Kinzai Institute for Financial Affairs, Inc. (in Japanese) revised edn.

Swanson, Eric T. 2015. Measuring the effects of unconventional monetary policy on asset prices. National Bureau of Economic Research Working Paper Series No. 21816.

Weinstein, David E. & Yishay Yafeh. 1998. On the costs of a bank-centered financial system: Evidence from the changing main bank relations in Japan. *Journal of Finance* 53(2). 635–672.

Wright, Jonathan H. 2012. What does monetary policy do to long-term interest rates at the zero lower bound? *Economic Journal* 122(564). F447–F466.

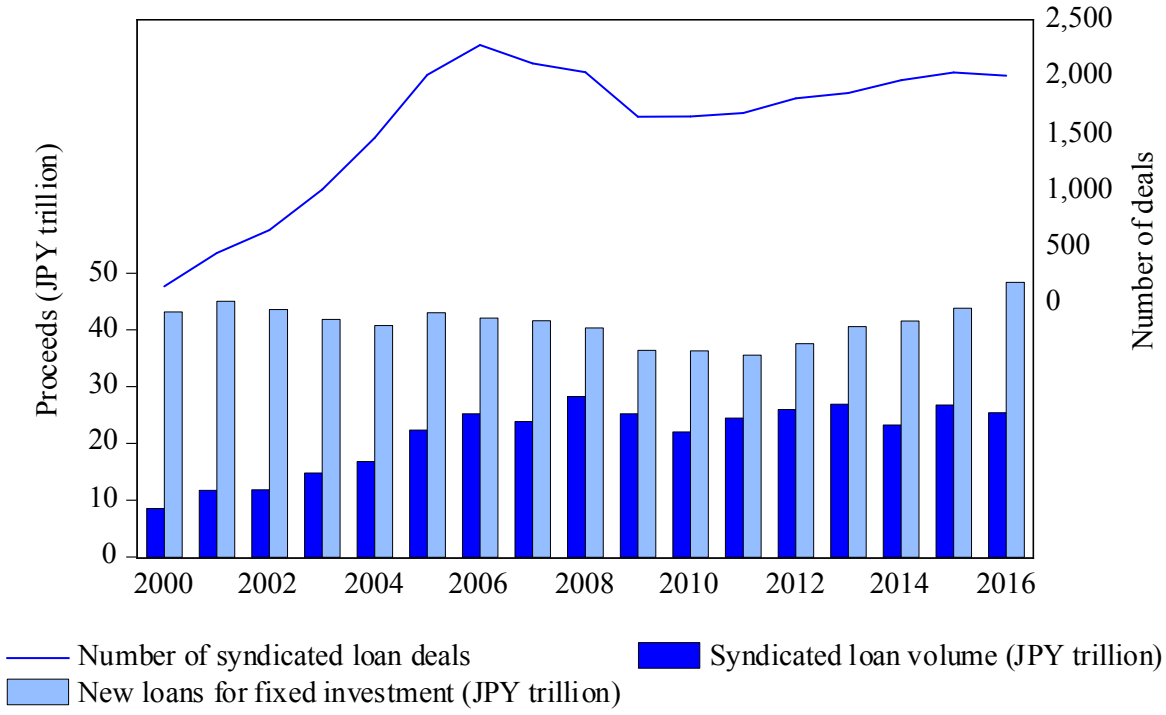

Figure 1: Trends of syndicated loans in Japan

Notes: This figure shows the number of annual syndicated loan deals and annual proceeds (JPY in trillion) of total new loans for fixed investment, and the syndicated loans issued in Japan from 2000 through 2016. The number of deals is shown as a solid line, and the proceeds are shown as bars.

Sources: Thomson Reuters and BOJ.

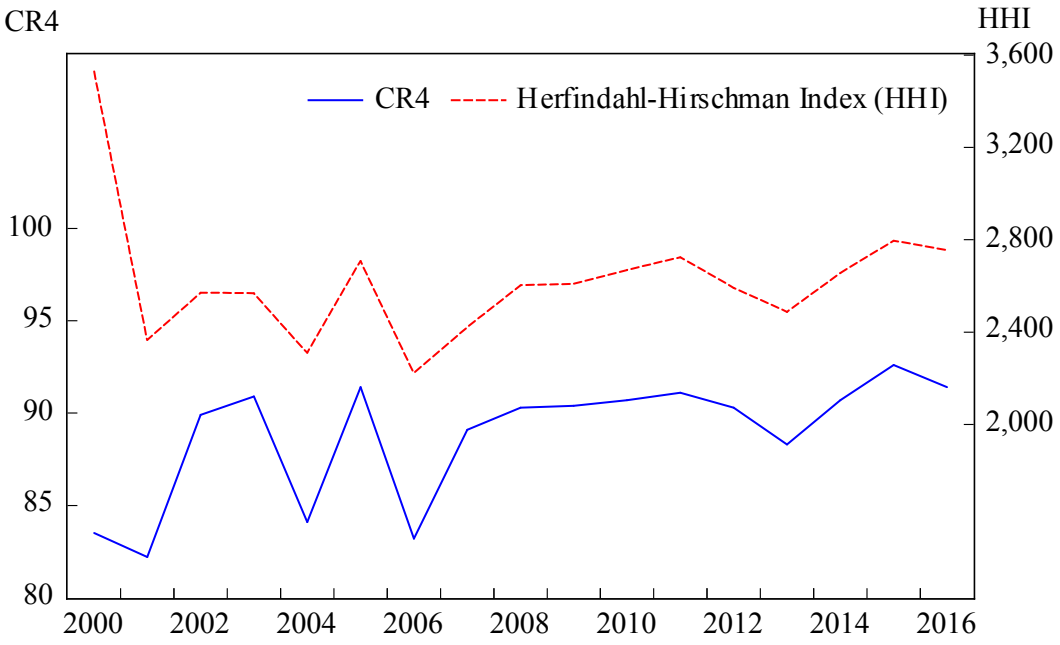

Figure 2: Concentration measures for lead arranger in Japanese syndicated loans

Note: This figure shows the annual four-firm concentration ratio (CR4) and the annual HHI of the Japanese syndicated loan lead arrangers from 2000 through 2016. *Source*: Own calculation using data from the Thomson One database.

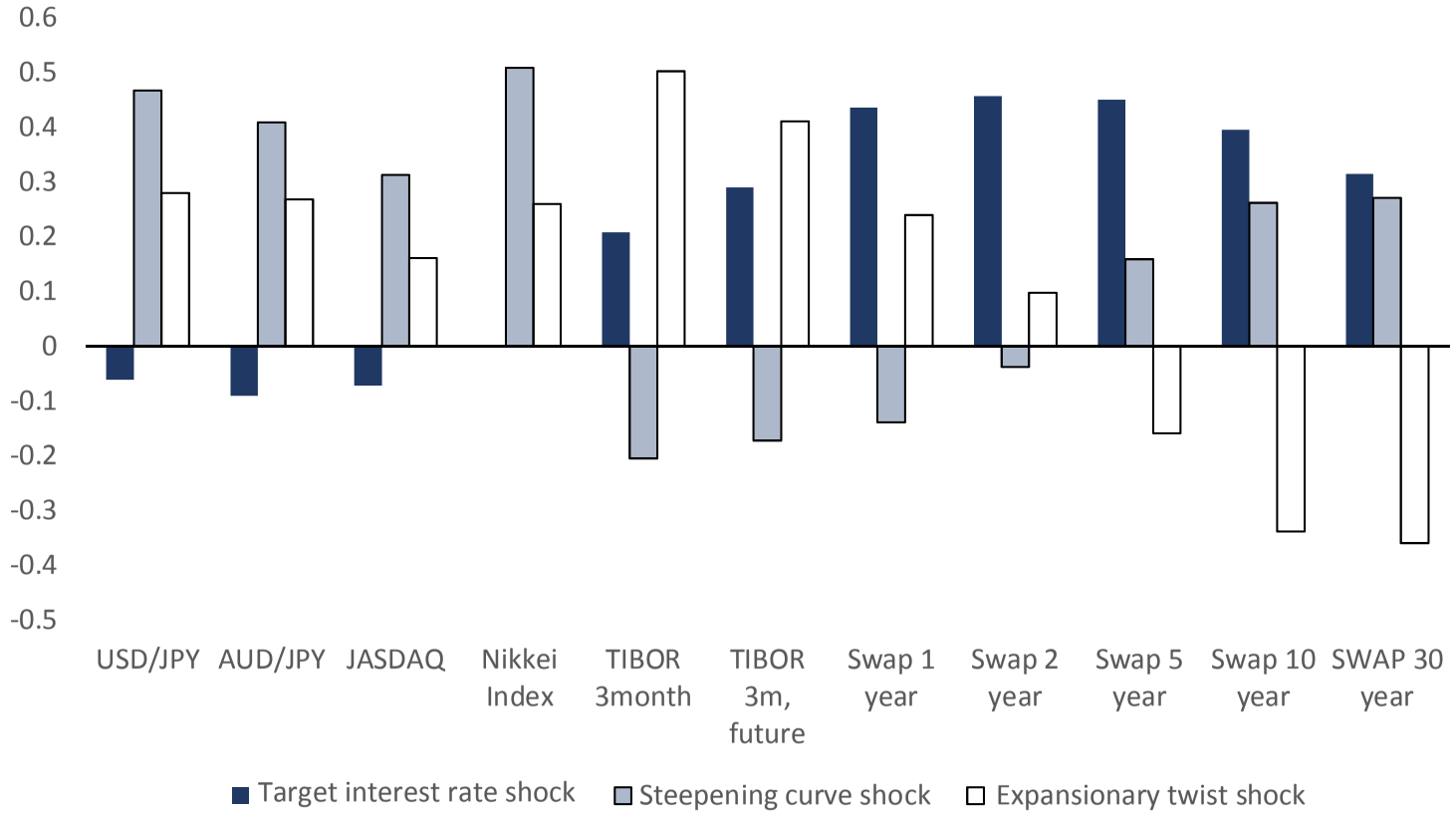

Figure 3: Factor loading of monetary policy shocks on financial market variables

Note: Each bar indicates the loadings on financial market variables used to extract common factors as monetary policy shocks.

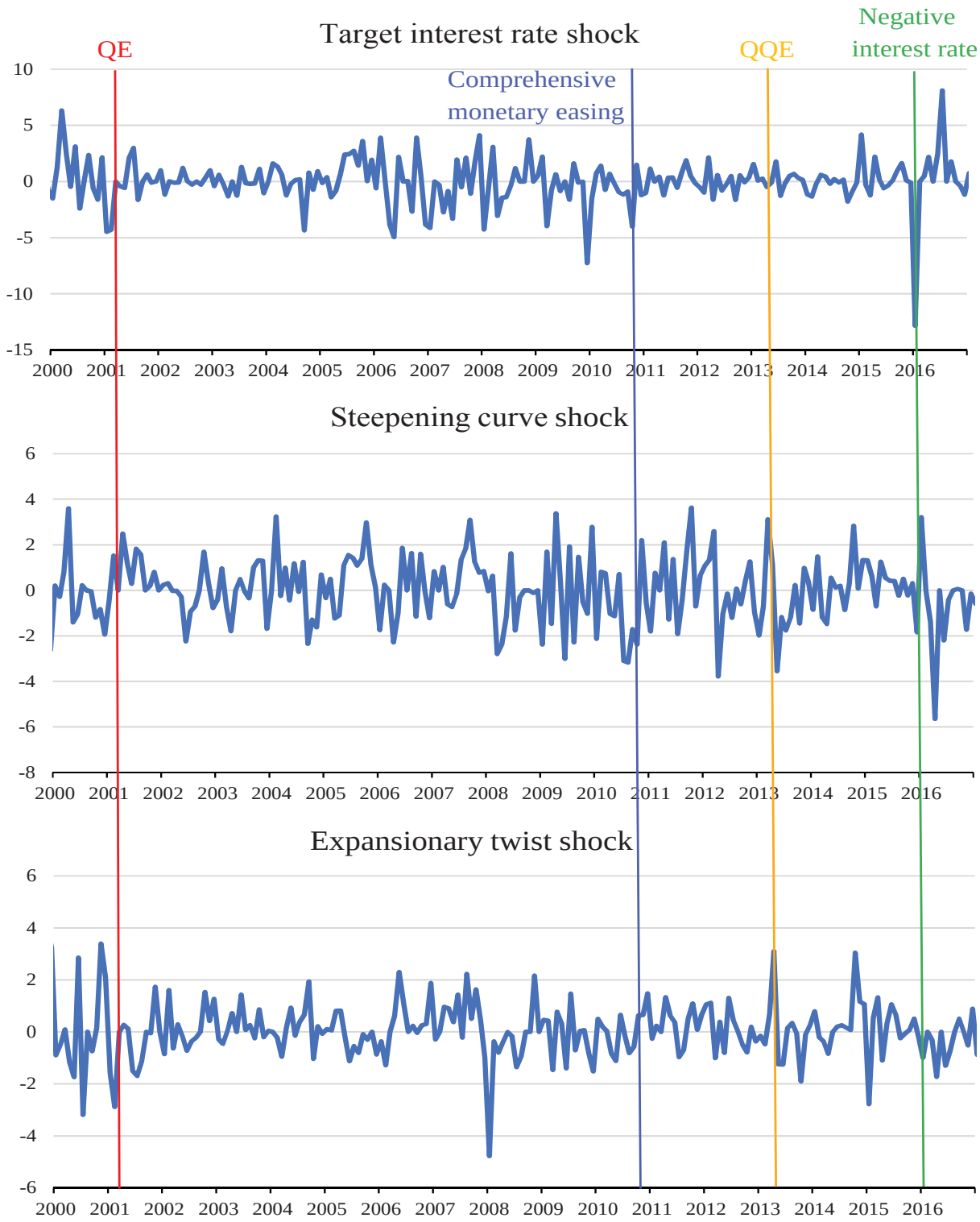

Figure 4: Development of monetary policy shocks

Note: Each monetary policy shock is extracted as a common component using 11 financial market variables through the principal component analysis, as described in the text.

Table 1: Descriptive statistics

	Obs.	25%	Median	Mean	75%	Std Dev
Maturity (months)	11,411	12	36	41.7	60	50.4
No of Lenders	11,411	2	4	4.8	6	3.8
Subordinated (dummy)	11,411	0	0	0	0	0.03
Volatility (30days)	11,411	22.5	31.7	35.8	44.4	20.5
ROE (%)	11,411	1.6	4	5.5	7.5	165.6
Long term debt to equity	11,411	0.1	0.2	0.2	0.3	0.1
Total debt to EBITDA	11,411	2.2	4.5	6.9	8.9	18.7
Sales growth (%)	11,411	-3	3	6.5	9.9	36
EBITDA growth (%)	11,411	-9.8	6.4	32.9	25.8	286.2
Total assets (JPY millions)	11,411	50,977	177,277	898,613	762,117	2,074,571
$Rating\ (dummies)$						
AAA	7,837	0	0	0.019	0	0.14
AA	7,837	0	0	0.12	0	0.34
A	7,837	0	0	0.42	1	0.49
BBB	7,837	0	0	0.37	1	0.48
BB	7,837	0	0	0.06	0	0.23
B	7,837	0	0	0.009	0	0.09
Spread (basis points)	580	46	70	82.31	100	57.05
Tenor (years)	580	1	3	3.48	5	4.12
$Rating\ (dummies)$						
AAA	543	0	0	0.004	0	0.06
AA	543	0	0	0.13	0	0.33
A	543	0	1	0.58	1	0.49
BBB	543	0	0	0.21	0	0.40
BB	543	0	0	0.08	0	0.28
B	543	0	0	0.004	0	0.06

Notes: The full sample is from January 1, 2000, to December 31, 2016. Owing to data restrictions as discussed in Section 3, a smaller sample is used to analyze loan spreads. Thus, for $Spread$, $Tenor$, and ***Rating dummies***, descriptive statistics is calculated using a smaller sample. $Rating\ dummy$ is a 0–1 dummy variable taking the value of unity when the issuing firm has a rating from AAA to B, and zero otherwise. $Spread$ is measured in basis points over TIBOR.

Table 2: Determinants of loan spreads

(*Dependent Variable:* Loan spread)

	(1)		(2)		(3)		(4)	
Variable	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
AA rating	-60.09	1.61			-101.42	4.16***		
A rating	-96.78	6.96***			-102.29	5.46***		
BBB rating	-69.39	5.50***			-77.05	4.17***		
BB rating	-27.06	1.43			-30.51	1.48		
Volatility			0.55	1.42			0.81	2.00**
ROE			0.14	0.17			1.42	1.84*
Long term debt to equity			-14.62	0.24			-28.03	0.51
Total debt to EBITDA			-0.09	0.68			-0.11	0.80
Sales growth			-0.05	0.70			-0.04	0.68
EBITDA growth			0.01	1.29			0.01	0.23
ln(Total assets)			-12.71	1.60			-19.23	2.30**
Tenor	4.82	10.53***	4.54	9.18***	5.54	12.30***	5.27	8.49***
Secured	-2.26	0.26	-10.25	1.41	-0.63	0.10	-7.59	1.39
No. of Lenders	0.08	0.21	0.19	0.41	0.27	0.62	0.40	0.71
Tranche type	YES		YES		YES		YES	
Lender countries	YES		YES		YES		YES	
Borrower FE	YES		YES		YES		YES	
Industry-year FE					YES		YES	
Observations	543		580		438		412	
R-squared	0.67		0.50		0.49		0.29	

Notes: This table reports results with borrower fixed effects and two-digit NAICS industry-by-year fixed effects for loan spread. The dependent variable is $Spread$ over TIBOR (in basis points). The estimated equations (1) and (2) also include a set of annual dummy variables. We drop singleton groups from the regression sample. t-ratios are the absolute values of t-statistics computed using robust standard errors. R-squared reports the within R-squared. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Estimates in this table use data from January 1, 2000, to December 31, 2016.

Table 3: Determinants of loan maturity

(*Dependent Variable:* Loan maturity in months)

	(1)		(2)		(3)	
Variable	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
AAA rating	17.21	1.67*			14.38	1.22
AA rating	3.07	0.38			1.46	0.15
A rating	5.96	1.16			4.20	0.75
BBB rating	6.57	1.48			4.60	0.94
BB rating	-4.36	1.16			-4.18	0.98
Volatility			-0.04	2.09**	-0.05	0.97
ROE			0.001	0.85	-0.002	0.33
Long term debt to equity			-4.95	0.55	-7.59	0.41
Total debt to EBITDA			0.02	0.68	0.03	0.61
Sales growth			0.02	2.11**	0.004	0.25
EBITDA growth			-0.003	2.78***	-0.004	1.78*
ln(Total assets)			1.72	0.94	-1.33	0.28
No. of Lenders	-0.46	2.57***	-0.59	3.47***	-0.58	2.78***
Subordinated	327.92	3.63***	420.33	4.17***	472.23	5.05***
Tranche type	YES		YES		YES	
Lender countries	YES		YES		YES	
Borrower FE	YES		YES		YES	
Industry-year FE	YES		YES		YES	
Observations	7,837		11,411		6,427	
R-squared	0.20		0.23		0.23	

Notes: This table reports results with borrower fixed effects and two-digit NAICS industry-by-year fixed effects for loan maturity. The dependent variable is $Maturity$ in months. We drop singleton groups from the regression sample. t-ratios are the absolute values of t-statistics computed using robust standard errors. R-squared reports the within R-squared. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Estimates in this table use data from January 1, 2000, to December 31, 2016.

Table 4: Credit supply conditions and loan spread
(*Dependent Variable:* Loan spread)

	(1)		(2)		(3)		(4)	
Variable	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Economic expansion	-150.87	1.36	38.17	0.17	-137.48	1.58	66.03	0.18
Lending attitude	-1.62	1.83*	-2.79	2.14**	-1.61	1.86*	-3.24	1.72*
AA rating	-44.28	1.20			-86.93	3.09***		
A rating	-86.46	6.40***			-95.63	4.52***		
BBB rating	-56.26	3.93***			-66.16	2.90***		
BB rating	-18.81	0.97			-31.76	1.35		
Volatility			0.47	1.28			1.16	1.84*
ROE			0.11	0.13			5.45	1.34
Long term debt to equity			-17.50	0.29			-13.55	0.24
Total debt to EBITDA			-0.07	0.50			0.38	1.44
Sales growth			-0.07	0.85			0.04	0.20
EBITDA growth			0.01	1.46			-0.35	1.07
ln(Total assets)			-13.47	1.73*			-54.27	2.49**
Tenor	4.85	10.69***	4.57	9.63***	4.70	9.99***	5.00	7.34***
Secured	-1.81	0.21	-8.88	1.16	-2.74	0.54	-8.85	1.33
Borrower FE	YES		YES		YES		YES	
Industry-year FE					YES		YES	
Bank-year FE					YES		YES	
Observations	543		580		391		365	
R-squared	0.68		0.51		0.40		0.23	

Notes: This table reports regression results obtained with macroeconomic control variables and bank-by-year fixed effects in addition to borrower fixed effects and two-digit NAICS industry-by-year fixed effects. The dependent variable is $Spread$ over TIBOR in basis points. *Economic expansion* is the growth rate of the Coincident index (CI), which is an index of Business Conditions published monthly by the Cabinet Office, government of Japan. *Lending attitude* is a statistical survey response about Lending Attitude of Financial Institutions in $Tankan$ (Short-term Economic Survey of Enterprises in Japan) conducted quarterly by the BOJ. Responses are aggregated into Diffusion Index by subtracting the percentage share of enterprises responding (3) Severe from that of (1) Accommodative. Estimates use the value for small enterprises. The estimated equations also include lender country dummies and tranche-type dummies. t-ratios are the absolute values of t-statistics computed using robust standard errors. R-squared reports the within R-squared. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Estimates in this table use data from January 1, 2000 to December 31, 2016.

Table 5: Credit supply conditions and loan maturity

(*Dependent Variable:* Loan maturity in months)

	(1)		(2)		(3)	
Variable	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Economic expansion	61.71	2.20**	31.64	1.71*	50.61	1.73*
Lending attitude	-0.42	1.45	-0.24	1.27	-0.55	1.80*
Economic expansion× Total Debt to EBITDA	0.11	2.10**	0.47	0.55	0.20	0.55
AAA rating	12.17	1.07			10.91	0.93
AA rating	-0.11	0.01			1.03	0.11
A rating	4.45	0.77			3.47	0.57
BBB rating	3.92	0.78			3.23	0.60
BB rating	-3.66	0.82			-3.61	0.77
Volatility			-0.05	2.41**	-0.07	1.35
ROE			0.001	1.17	-0.001	0.16
Long term debt to equity			-2.85	0.29	-9.96	0.49
Total debt to EBITDA			0.01	0.51	-0.001	0.29
Sales growth			0.02	2.10**	0.02	1.14
EBITDA growth			-0.003	2.81***	0.0002	0.87
No. of Lenders	-0.52	2.66***	-0.60	3.60***	-0.55	2.73***
Subordinated	439.51	4.06***	381.13	3.41***	439.70	4.05***
Borrower FE	YES		YES		YES	
Industry-year FE	YES		YES		YES	
Bank-year FE	YES		YES		YES	
Observations	6,615		11,198		6,305	
R-squared	0.20		0.21		0.20	

Notes: This table reports regression results obtained with macroeconomic control variables and bank-by-year fixed effects in addition to borrower fixed effects and two-digit NAICS industry-by-year fixed effects. The definition of macroeconomic control variables are in Table 4. The dependent variable is $Maturity$ in months. The estimated equations also include lender country dummies and tranche-type dummies. t-ratios are the absolute values of t-statistics computed using robust standard errors. R-squared reports the within R-squared. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Estimates in this table use data from January 1, 2000 to December 31, 2016.

Table 6: Monetary policy shocks and loan spread
(*Dependent Variable:* Loan spread)

	All observations		With access to bonds		Without access to bonds
	(1)	(2)	(3)	(4)	(5)
Target interest rate shock	4.09	1.01	-1.78	0.69	6.66
	(1.95)*	(0.68)	(0.76)	(0.44)	(0.43)
Steepening curve shock	-6.72	-0.44	-0.78	-1.24	-7.75
	(2.52)**	(0.38)	(0.39)	(1.09)	(0.87)
Expansionary twist shock	10.21	-0.66	-0.49	-0.91	34.14
	(2.38)**	(0.37)	(0.16)	(0.48)	(1.13)
Economic expansion	16.93	-137.08	-67.75	-137.87	922.73
	(0.05)	(1.43)	(0.44)	(1.55)	(0.73)
Lending attitude	-2.36	-1.43	-1.53	-1.43	-8.26
	(1.24)	(1.66)*	(0.89)	(1.67)*	(0.93)
AA rating		-66.28		-22.76	
		(3.00)***		(1.48)	
A rating		-67.92		-24.17	
		(4.52)***		(3.04)***	
BBB rating		-45.43			
		(3.04)***			
Volatility	1.38		0.36		
	(1.55)		(1.24)		
ROE	15.51		6.81		
	(2.68)***		(2.01)**		
Long term debt to equity	-0.47		-0.55		
	(1.48)		(2.41)**		
Total debt to EBITDA	0.89		0.32		
	(3.01)***		(1.67)*		
Sales growth	0.41		-0.42		
	(1.23)		(1.34)		
EBITDA growth	-1.16		-0.27		
	(2.33)**		(0.87)		
ln(Total assets)	-78.46		-3.69		
	(2.80)***		(0.15)		
Tenor	4.70	4.71	4.63	4.38	8.98
	(6.82)***	(9.63)***	(7.70)***	(9.37)***	(5.39)***

Continued

Table 6: Continued

	All observations		With access to bonds		Without access to bonds
	(1)	(2)	(3)	(4)	(5)
Secured	-9.28	-8.87	-13.37	-5.33	1.90
	(0.82)	(1.62)	(2.51)**	(0.99)	(0.11)
Lender countries	YES	YES	YES	YES	YES
Borrower FE	YES	YES	YES	YES	YES
Industry-year FE	YES	YES	YES	YES	YES
Bank-year FE	YES	YES	YES	YES	YES
Observations	327	353	231	321	220
R-squared	0.29	0.44	0.51	0.44	0.29

Notes: This table reports regression results obtained with the monetary policy shock variables and explanatory variables in Table 4. Monetary policy shock variables are three principal components along with the three largest eigenvalues from the changes in 11 financial asset variables, as shown in Figure 3. The dependent variable is $Spread$ over TIBOR in basis points. The estimated equations also include a set of tranche-type dummies. Macroeconomic control variables are the same set as in Table 4. A set of explanatory variables in (5) includes neither rating variables nor financial indicator variables to maximize the sample size. t-ratios reported in parentheses are the absolute values of t-statistics computed using robust standard. R-squared reports the within R-squared. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Estimates in this table use data from January 1, 2000, to December 31, 2016.

Table 7: Monetary policy shocks and loan maturity
(*Dependent Variable:* Loan maturity in months)

	All observations		With access to bonds		Without access to bonds	
	(1)	(2)	(3)	(4)	(5)	(6)
Target interest rate shock	-1.15	-0.70	-0.90	-0.90	-3.13	0.04
	(2.52)**	(2.32)**	(1.88)*	(1.80)*	(2.46)**	(0.34)
Steepening curve shock	0.82	0.49	0.74	0.78	4.47	-0.20
	(1.91)*	(1.72)*	(1.65)*	(1.67)*	(1.82)*	(1.24)
Expansionary twist shock	-1.23	-0.69	-1.23	-1.25	-3.35	0.20
	(2.90)***	(2.46)**	(2.72)***	(2.58)***	(1.33)	(0.98)
Economic expansion	-6.16	-8.46	15.98	3.94	-201.08	-0.81
	(0.17)	(0.35)	(0.44)	(0.10)	(1.39)	(0.04)
Lending attitude	0.23	0.20	0.05	0.01	-2.08	-0.16
	(0.66)	(0.79)	(0.15)	(0.03)	(0.63)	(0.77)
Economic expansion×	0.12	0.49	0.12	0.33	3.65	1.28
Total Debt to EBITDA	(2.23)**	(0.55)	(2.25)**	(0.36)	(0.46)	(0.86)
AAA rating	14.82		6.63			
	(1.32)		(0.66)			
AA rating	1.27		-7.49			
	(0.14)		(1.04)			
A rating	5.59		-1.36			
	(0.97)		(0.35)			
BBB rating	4.92					
	(0.96)					
BB rating	-2.69				15.86	
	(0.59)				(1.16)	
Volatility		-0.04		-0.02		-0.04
		(1.93)*		(0.37)		(2.68)***
ROE		0.001		-0.05		0.0003
		(1.15)		(0.84)		(0.42)
Long term debt to equity		-2.47		-11.58		1.68
		(0.26)		(0.52)		(0.27)
Total debt to EBITDA		0.01		0.03		-0.02
		(0.41)		(0.55)		(0.74)
Sales growth		0.02		0.02		0.01
		(2.00)**		(0.99)		(0.86)

Continued

Table 7: Continued

	All observations		With access to bonds		Without access to bonds	
	(1)	(2)	(3)	(4)	(5)	(6)
EBITDA growth		-0.003		-0.01		-0.002
		(2.72)***		(1.56)		(1.84)*
ln(Total assets)		2.23		-4.22		2.23
		(1.09)		(0.66)		(1.39)
No. of lenders	-0.52	-0.60	-0.59	-0.65	-0.54	-0.34
	(2.64)***	(3.58)***	(2.61)***	(2.79)***	(1.12)	(2.39)**
Subordinated	440.34	381.58	411.80	411.12	na	237.25
	(4.08)***	(3.41)***	(3.26)***	(3.24)***		(1.52)
Lender countries	YES	YES	YES	YES	YES	YES
Borrower FE	YES	YES	YES	YES	YES	YES
Industry-year FE	YES	YES	YES	YES	YES	YES
Bank-year FE	YES	YES	YES	YES	YES	YES
Observations	6,615	11,198	6,135	5,807	394	5,205
R-squared	0.21	0.21	0.20	0.20	0.19	0.37

This table reports regression results obtained with the monetary policy shock variables and explanatory variables in Table 5. Monetary policy shock variables are three principal components along with the three largest eigenvalues from the changes in 11 financial asset variables, as shown in Figure 3. The dependent variable is $Maturity$ in months. The estimated equations also include tranche-type dummies. Macroeconomic control variables are the same set as in Table 4. t-ratios are the absolute values of t-statistics computed using robust standard errors. R-squared reports the within R-squared. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Estimates in this table use data from January 1, 2000, to December 31, 2016.

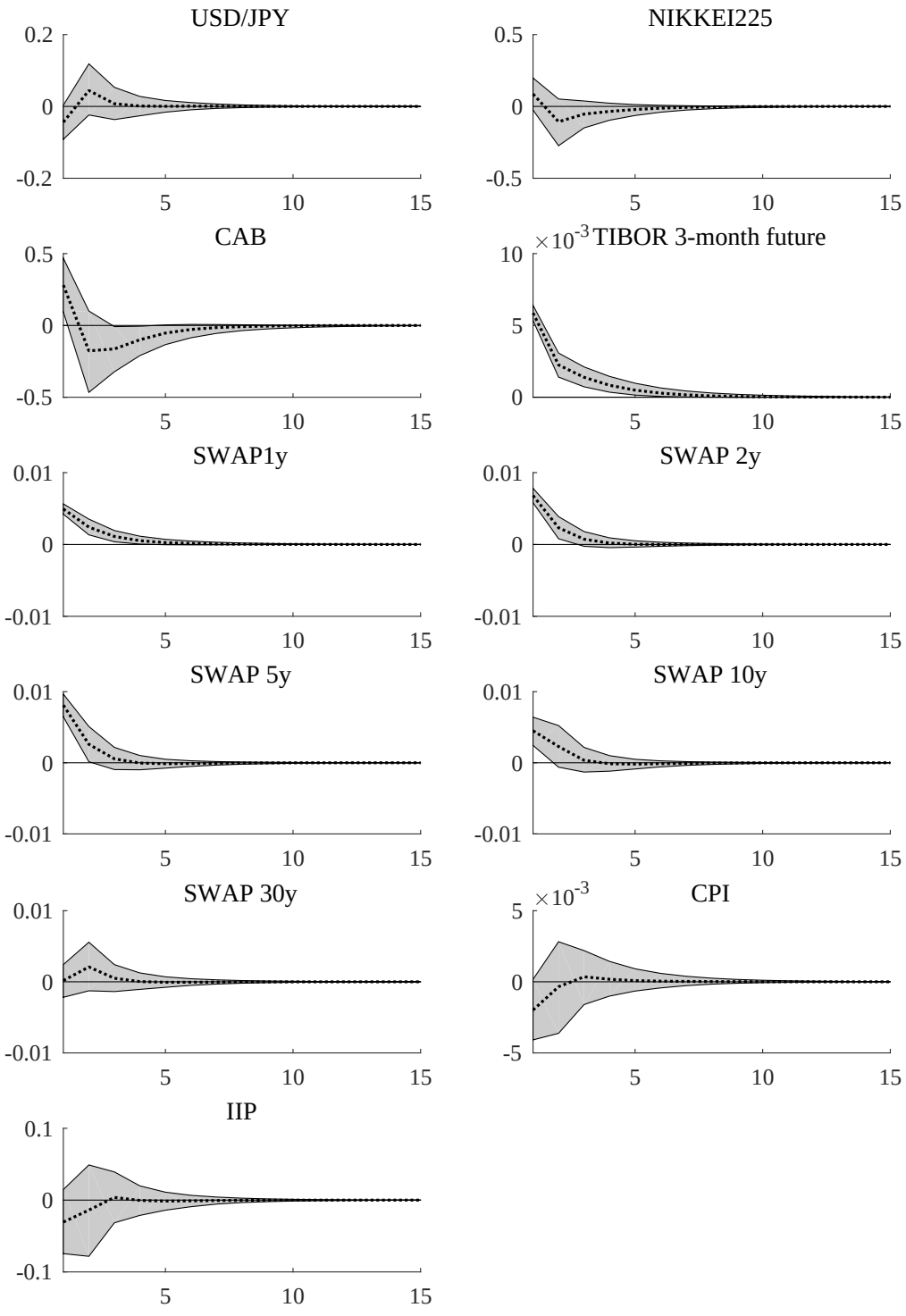

Figure B1: IRFs to a Target Interest Rate Shock

Note: The solid line indicates the median of the estimated IRFs to a positive *target interest rate shock* of one standard deviation based on the bootstrap method by resampling 3,000 times. The shadow area indicates 90% confidence interval based on the bootstrap.

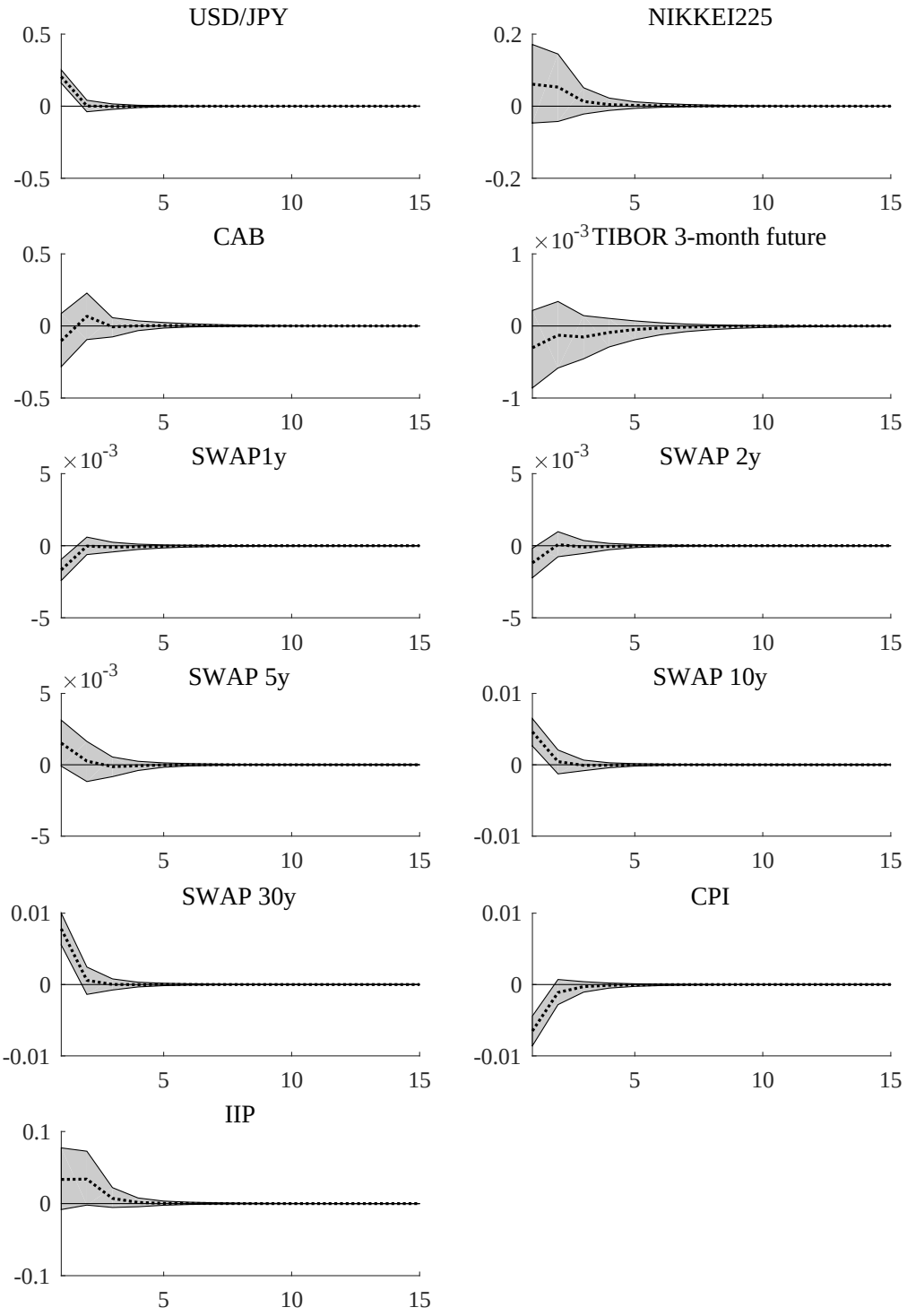

Figure B2: IRFs to a Steepening Curve Shock

Note: The solid line indicates the median of the estimated IRFs to a positive *steepening curve shock* of one standard deviation based on the bootstrap method by resampling 3,000 times. The shadow area indicates 90% confidence interval based on the bootstrap.

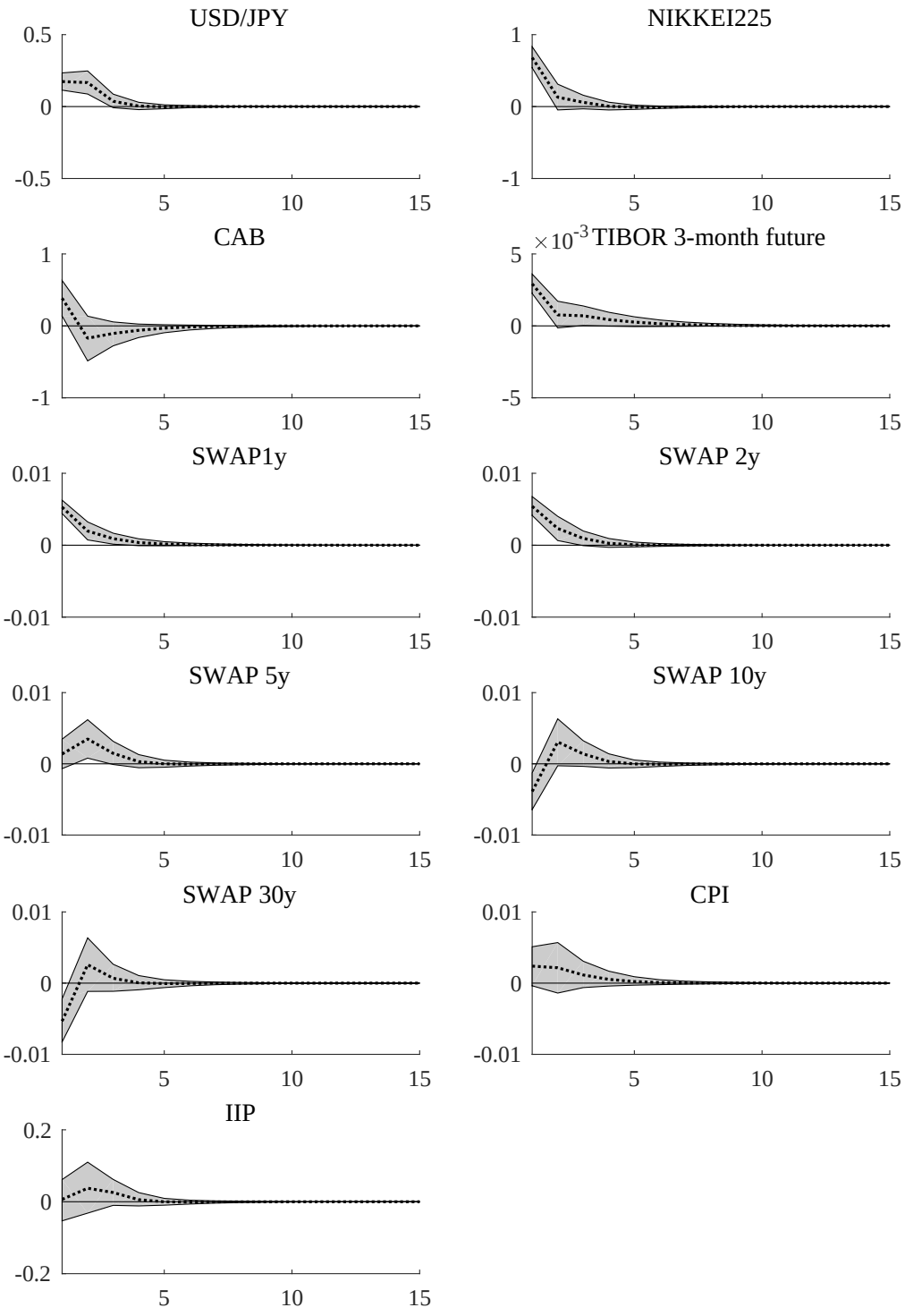

Figure B3: IRFs to an Expansionary Twist Shock

$Note$: The solid line indicates the median of the estimated IRFs to a positive *expansionary twist shock* of one standard deviation based on the bootstrap method by resampling 3,000 times. The shadow area indicates 90% confidence interval based on the bootstrap.